SEPTEMBER 19, 1958

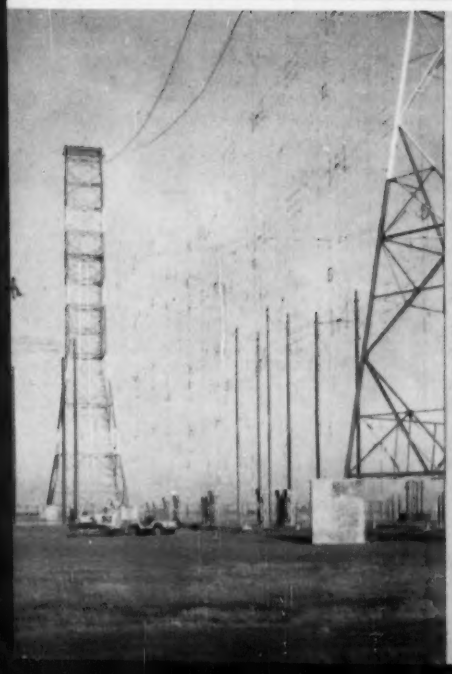
electronics

business issue

A McGRAW-HILL PUBLICATION · VOL. 31, NO. 38 · PRICE FIFTY CENTS

Interceptor Missile Stockpile Grows

Number of guidance-system types almost equals number of missile models...p 15



Radio Crashes Barriers Abroad

American broadcasts fight jamming and anti-U.S. feeling overseas...p 17

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UNIVERSITY MICROFILMS IN
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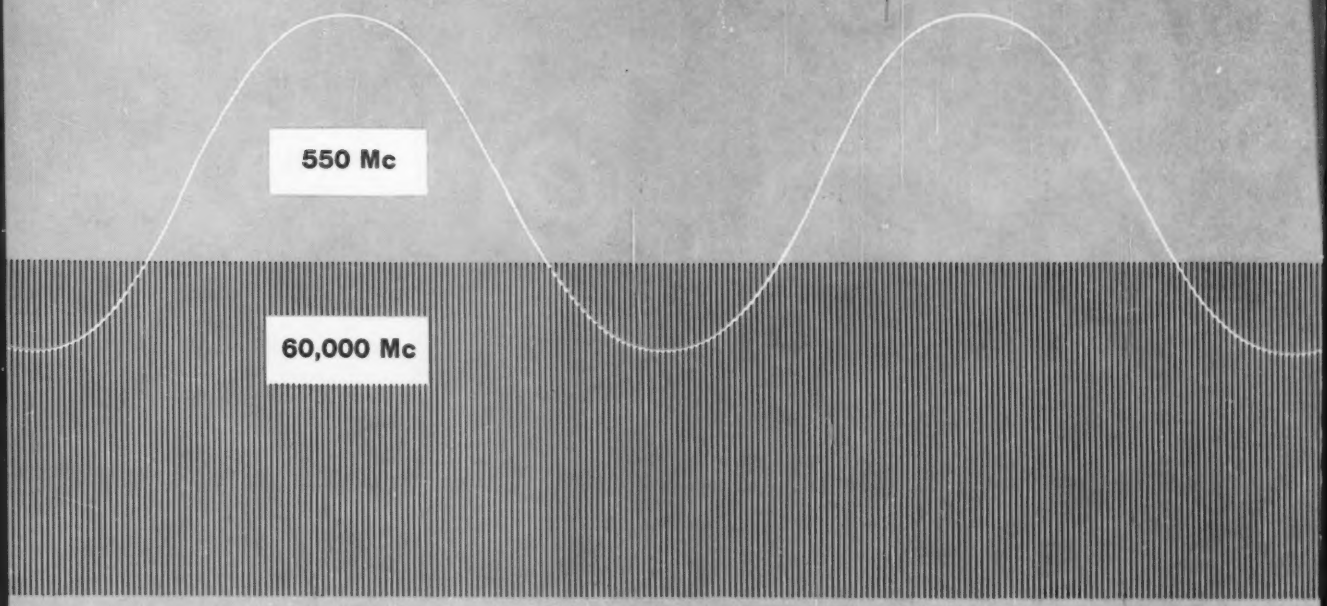
Raytheon — World's Largest Manufacturer of Magnetrons and Klystrons



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More than 70 Raytheon reflex-type klystrons for local oscillator, signal generator and transmitter applications.

Raytheon produces more reflex klystrons than all other manufacturers in the world combined . . . one important reason why Raytheon klystrons have established a matchless record for reliability and proved performance in thousands of installations.

Equipment designers are welcome to call on our Application Engineer Service. Write for consolidated data booklet presenting comprehensive characteristics of the *complete* line of Raytheon klystrons, magnetrons and special tubes. There is no cost, or obligation.

3 TYPICAL RAYTHEON REFLEX KLYSTRONS

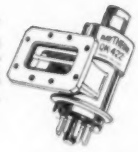
RK-5721 – Velocity variation oscillator designed for use with a coaxial cavity in CW or pulsed operation over the 4290 to 11,000 Mc range for signal generator and special local oscillator applications.

Heater Input @ 0.58 A	6.3 V
Reflector Voltage Transit Mode	2¾ cycles
Frequency Range	4290-8340 Mc
DC Resonator Input @ 20 mA	1000 Vdc
DC Reflector Voltage	-50 to -625 V
Electronic Tuning (Half Power) Frequency Change	12 Mc min.
Reflector Modulation Sensitivity (8340 Mc)	0.1 Mc/volt
Power Output (Average CW)	160 mW

RK-6116 – A ruggedized thermally tuned oscillator of the integral cavity type designed for CW operation in the 8500 to 9600 Mc range with an average power output of 30 mW.

Heater Input @ 0.52 A	6.3 V
Tuner Heater Current	0.80 A
Frequency Range	8500-9660 Mc
Resonator Input @ 25 mA	300 Vdc
Reflector Voltage (max. Po @ 8550 to 9660 Mc)	-60 to -145 Vdc
Thermal Tuning Time 8500-9660 Mc	2 seconds
Electronic Tuning Range @ 9080 Mc	100 Mc
Power Output 8500-9660 Mc	26 to 34 mW

QK-422–A mechanically tuned velocity variation oscillator designed for CW operation in the 7125 to 8125 Mc range in microwave relay systems.



Heater Input @ .44 A	6.3 V
Frequency Range	7125 to 8125 Mc
DC Resonator Input @ 32 mA	300 Vdc
DC Reflector Voltage (max. Po @ 7125 to 8125 Mc)	-130 to -210 Vdc
Power Output 7125 to 8125 Mc	100 mW min.
Electronic Tuning (to half power points) @ 7600 Mc	25 Mc min.
Modulation Sensitivity @ 7600 Mc (10 V pk. to pk. mod. volt.)	.5 Mc/V min.

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Shoptalk . . .

BROADCASTING OVERSEAS. When the Soviets jammed Voice of America broadcasts of the UN General Assembly sessions last month, they drowned out not only President Eisenhower's presentation of a six-point Middle East program, but also the speech by Soviet Foreign Minister Gromyko.

Soviet bloc jamming underscores the vital role of new transmitting gear in pushing radio news over the Iron Transom.

In the Middle East too, where U. S. policy is little understood, nationalism runs feverishly high and Communist propaganda stoops low, the problem of broadcasting the record straight is getting new attention. On p 17 Associate Editor Janis describes some of the problems involved in getting ourselves heard abroad.

FULL FATHOM FIVE. A major submersible command post might be an accurate description of the Navy's newly launched nuclear submarine *Triton*. Not only will her own air search radar reach out upwards of 500 miles but her combat-information-center consoles will also display radar data from long-ranging search aircraft.

Still another aspect of this undersea giant's electronic mission: she'll pack a lot of both active and passive countermeasures gear.

Associate Editor Leary saw more than champagne, brass bands and kisses when the Navy sent the *Triton* down the ways last month. For the full electronics story about our largest submarine, see his account on p 20.

AREA DEFENSE INTERCEPTOR MISSILES. Surface-to-air antiaircraft guided missiles defending our fleet and strategic land areas are steadily building in ratio to manned fighters. By mid-1960's, 60 percent of our air defense force will be missile units, 40 percent manned interceptors.

Ten fleet and land-based guided missiles, using seven guidance systems, make up the current known program. Army, for Nike Ajax and Hercules alone, will spend $477.2 million in fiscal 1959 on contracts made prior to '59.

For a rundown on guidance and related electronic equipment, the status and future of missiles in this category, Associate Editor Mason talked with Army, Navy and USAF officials, prime and guidance contractors, and visited and photographed equipment on the *USS Canberra* (see cover photo). His article begins on p 15.

MEN WANTED. With industry leaders forecasting more profits this half, and even better business next year, the problem arises: How to turn rosy promises into accounts receivable?

Many electronics manufacturers are looking over their sales forces, beefing them up for the big selling job ahead.

Midwestern Editor Harris tells how several Chicago sales managers have attacked the problem of looking over a wide selection of sales engineering candidates without running through a long series of exhausting, time-consuming personal interviews. His story appears on p 19.

Coming in Our September 26 Issue . . .

Coming in Our September 26 Issue . . .

● **Low-Noise Mavars.** The principles of parametric or reactance amplification have been well known for a long time, but practical exploitation of these principles has awaited the development of new materials and techniques. Now the advent of ferrites, semiconductor materials and electron-beam devices makes possible wide-band amplification of microwave signals at incredibly low noise figures, achieved heretofore only with the super-cooled maser (ELECTRONICS, p 66, April 25).

To get the complete story of this significant development, Associate Editor Weber visited laboratories and talked to scientists deeply involved in mavar research. He saw eye-opening demonstrations of mavar capabilities, culled dozens of technical reports and papers. Next week his article describes the theory, operation and state of the art of this latest extension of the microwave frontier.

● **High-Speed Readout.** Combining the Charactron shaped-beam tube and a Xerographic dry printer makes it possible to record one million typewritten characters per minute, according to J. T. McNaney, Technical Director of Stromberg-Carlson-San Diego.

In his article, McNaney shows how pulse-code data derived from information sources such as computers, data processors or telecommunications networks can be converted to printed records in the form of letters, charts and graphs.

● **Converter Design.** Systematic design of a-c to d-c converters using transistors is simplified in a method outlined by Stanley Schenkerman of Ford Instrument Co.

Schenkerman presents two nomographs and a table to aid the designer in the selection of circuit parameters. An example of design of a 1,000-cps symmetrical converter operating from a 30-v source and delivering 120 v to a 200-ohm load is given. The technique is applicable to many variations of the basic, two-transistor symmetrical circuit.

● **Spectrum Conservation.** A nonuniform scanning system suitable for facsimile-type transmission resulting in more efficient utilization of channel capacity is outlined by H. E. Haynes and D. T. Hoger of RCA in Camden. In transmission of data involving only uniform black or white areas, a scanning spot sweeps at a rapid rate until a boundary is encountered. The spot then stops for a precisely controlled interval, then resumes the fixed scanning speed.

With this system in a narrow-band transmission channel, time reductions approaching 10 to 1 for simple images have been achieved. This figure reduces to 3 to 1 for highly detailed images.

electronics business issue

A McGRAW-HILL PUBLICATION • VOL. 31, NO. 38 • SEPTEMBER 19, 1958

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Issue at a Glance

Executive Salaries. Average 1957 pay boost for top electronics executives was more than double general industry's.....p 7

Shares and Prices. New public issues in first half.....p 7

Mergers, Acquisitions and Finance.....p 8

Figures of the Week.....p 8

Washington Outlook .....p 10

Executives in the News. Fisk of Bell Telephone Laboratories.....p 12

Comment .....p 12

Interceptor Missile Pile Grows. A multibillion dollar market for electronic missile gear lies in North American Air Defense's goal of a 60-percent missile and 40-percent manned-interceptor air defense force by the mid-1960's .....p 15

Radio Crashes Iron Curtain. Voice of America broadcasts fight jamming by the USSR and her satellites. VOA's current $27-million, three-year expansion program includes more powerful transmitters on our East Coast .....p 17

Production and Sales. Tape sales increase 33% to $24 million.....p 18

How to Hire Sales Engineers. Here's one way sales managers seeking men can evaluate a larger field of candidates. It saves time, and wear and tear on vocal cords.....p 19

Undersea Radar Station. Controls for twin-reactor power plant are only a small part of the electronics aboard U. S. Navy's new radar picket submarine .....p 20

DIGEST CONTINUED ON NEXT PAGE

DIGEST continued

Engineering Report ..... p 23

Aircraft Controls Share Computer — Technical Digest
Liquid Cools Inertial Components — Meetings Ahead
Electronic Ingot Buggy

Components and Materials ..... p 26

Mica Tariff Cut — Solar Generator Works to 750 C
Millimicrosecond Switch — Magnetic Value Redetermined

Weather Probe Begins. New equipment buying seen as USAF launches an all-out, aerial attack on problem of global weather forecasting ..... p 28

Military Electronics ..... p 28

Contracts Awarded ..... p 28

New Products ..... p 30

Literature of the Week ..... p 38

Japanese Push Radioisotopes. Experts see new applications, increased instrument output as studies continue ..... p 40

Developments Abroad ..... p 40

Exports and Imports ..... p 40

Rise Seen in Taped Tv. Use of tape in making tv commercials is pointing the way to new sales of recorders and tv camera chains ..... p 44

FCC Actions ..... p 44

Station Moves and Plans ..... p 44

Plants and People ..... p 46

News of Reps ..... p 48

Index to Advertisers ..... p 48

electronics

Sept. 19, 1958 Vol. 31, No. 38

Published weekly, with alternating engineering and business issues and with a BUYERS' GUIDE issue in mid-June, by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948) Founder.

Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 W. 42 St., New York 36, N. Y. Longacre 4-3000.

Publication Office: 99-129 North Broadway, Albany 1, N. Y. See panel below for directions regarding subscription or change of address. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Single copies $1.00 for Engineering Issue and 50¢ for Business Issue in United States and possessions, and Canada; $2.00 and $1.00 for all other foreign countries. Buyers' Guide $3.00. Subscription rates—United States and possessions, $6.00 a year; $9.00 for two years; $12.00 for three years. Canada, $10.00 a year; $16 for two years; $20.00 for three years. All other countries, $20.00 a year; $30.00 for two years; $40.00 for three years. Second class mail privileges authorized at Albany, N. Y. Printed in U.S.A.

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BRANCH OFFICES: 520 North Michigan Avenue, Chicago 11; 68 Post Street, San Francisco 4; McGraw-Hill House, London E. C. 4; 15, Landgrat-Wilhelm, Frankfurt/Main; National Press Bldg., Washington 4, D. C.; Six Penn Center Plaza, Philadelphia 3; 1111 Henry W. Oliver Bldg., Pittsburgh 22; 55 Public Square, Cleveland 33; 856 Penobscot Bldg., Detroit 26; 3615 Olive St., St. Louis 8; 350 Park Square Bldg., Boston 16; 1321 Rhodes Haverty Bldg., Atlanta 3; 1125 West Sixth St., Los Angeles 17; 1740 Broadway, Denver 2. ELECTRONICS is indexed regularly in The Engineering Index.

Subscriptions: Address correspondence to: Fulfillment Manager, Electronics, 330 W. 42nd St., New York 36, N. Y. Allow one month for changes of address, stating old as well as new address. Subscriptions are solicited only from persons engaged in theory, research, design, production, management, maintenance and use of electronics and industrial control components, parts and products. Position and company connection must be indicated on subscription orders.

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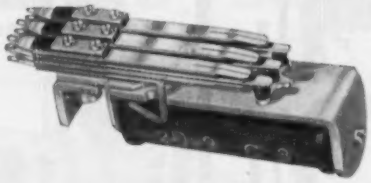

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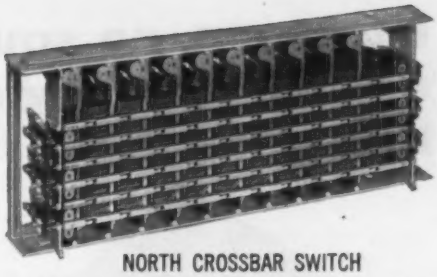

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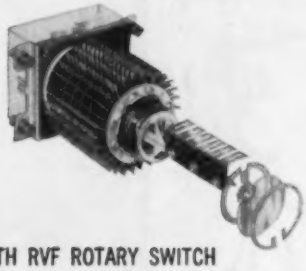
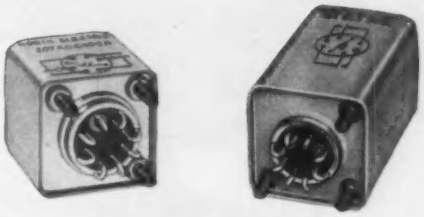
The most economical means of providing maximum switching capacity (inputs to outputs) with relay reliability.



NORTH RVF ROTARY SWITCH

Advanced bank and wiper design affords new flexibility in rotary switch application.



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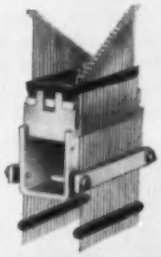
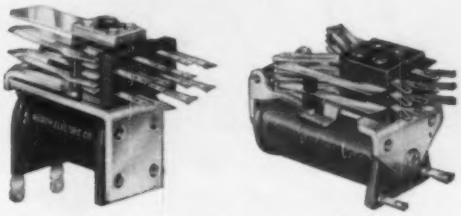
Hermetically sealed general purpose and sensitive relays - high shock and vibration resistance meeting Mil. specs.

NORTH REED ARMATURE RELAY



Exceeds critical requirements in data switching systems where high speed, low level signals must be handled with minimum interference between channels.



NORTH "M" AND "E" TYPE RELAYS

Telephone type dependability in miniature size where space requirements are critical.

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North engineers, specialists for over 75 years in the design, production and application of relays and switch gear, can take over your control system design problems and solve them beyond your specifications. The accumulated know-how of three quarters of a century in this specialized field can be applied to help you - in design, in component specification, and in complete system manufacture.

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Still further probing the Unknown, *-hp-* engineers achieved the *-hp-* 116A Storage Unit and 117A Storage Drawers. The 116A is a sophisticated cube known as a "box." It holds up to 3 plug-in units for *-hp-* 150A/AR 'scopes; prevents dust and elbows in the circuitry. Yours for $22.50. The 116A also holds up to three 117A drawers which in turn hold tools, solder, components and bubble gum. *-hp-* 117A, a modest $10.

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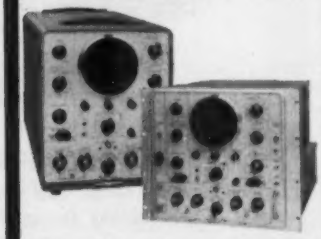
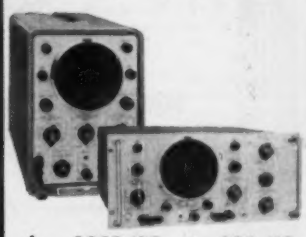
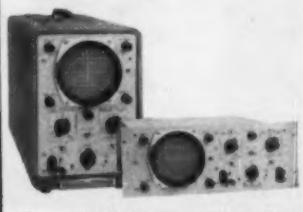


-hp- 150A/AR - to 10 MC
Automatic trigger, direct-reading; plug-ins providing dual trace or differential input; or high amplification. *-hp-* 150AR (rack) $1,200. *-hp-* 150A (cabinets) $1,100.



-hp- 130B/BR - to 300 KC
1 mv sensitivity, similar X/Y amplifiers, direct reading, automatic trigger, X5 magnifier, balanced on 6 most sensitive ranges. *-hp-* 130B (cabinet) or 130BR (rack), $650.



-hp- 120A/AR - to 200 KC
Sweeps 1 μsec/cm to 0.5 sec/cm; X5 sweep magnifier, automatic trigger, high sensitivity calibrated vertical amplifiers, regulated power supplies. *-hp-* 120AR (rack mount, 7" high) or 120A (cabinet) $435.

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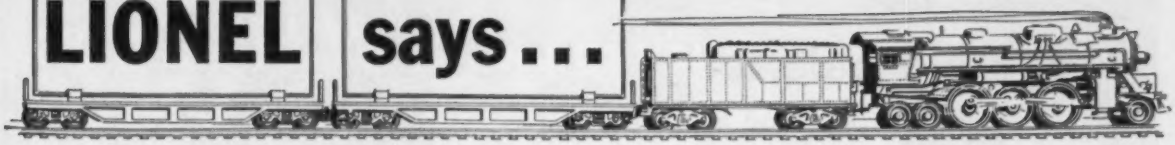
over 300 instruments for measuring speed and accuracy

LIONEL says...



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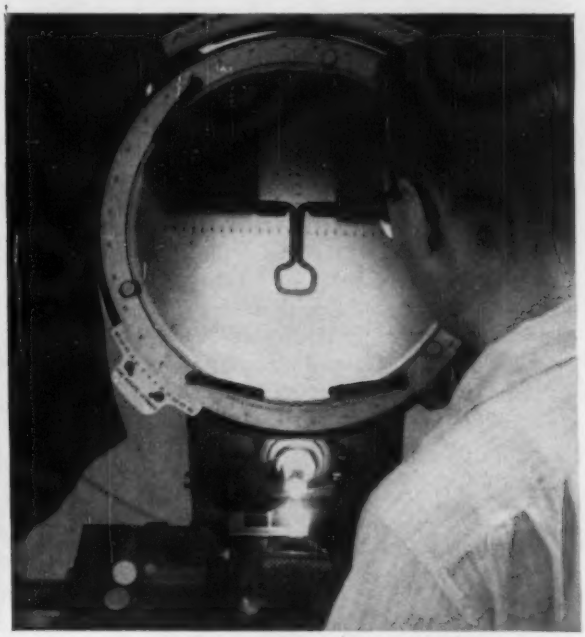
checking the critical dimensions of an armature commutator



new "T" rail is one of many parts held to very close tolerances

Many manufacturers of mass-produced precision parts and components face these demanding inspection requirements: – *Speed,* to keep pace with production; *Extreme accuracy,* for tolerances as close as .0001"; *Flexibility,* because of variety of parts, and different types of inspections and measurements needed; *Reliability,* for sure quality control; *Ease of operation and maintenance,* for steady day-in, day-out performance.

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Executive Salaries

Average 1957 pay boost for top electronics executives was more than double general industry's

AVERAGE PAY of an electronics firm's chief executive increased 2.3 percent in 1957 over 1956, according to latest available figures. This hike was more than twice the average in general industry, where typical top executive compensation went up 1.0 percent.

These facts are in the recently released annual survey of top management compensation by McKinsey & Co., management consultants. The consulting firm's observations were drawn from survey responses by 642 firms with sales ranging from $5 million to $7.8 billion. Included were 40 electronics and diversified firms with sales of $8 million to $4.3 billion.

Not all executives gained. Twenty-one percent in the electronics group made less in 1957 than in 1956; some 34 percent received same salary, and 45 percent won pay increases. In the general industry group, 43 percent got increases, 27 percent took pay cuts and 30 percent received the same salary.

Relatively small increases in top management pay for both general industry and electronics industry groups primarily reflect the impact of the recession and last Fall's cutback in military spending, says McKinsey associate Robert T. MacDonald. Company earnings for the general industry group were down 1.4 percent in 1957. Earnings for electronics companies were up 12.6 percent.

Typical electronics firm head makes slightly more than the chief executive in the all-industry group.

Second, third and fourth ranking executives in the electronics industry also fared better than their counterparts in general industry.

In our industry, number two executive was usually paid 79 percent of amount paid the chief executive, while all industry's number-two exec normally got 69 percent of top man's pay, the survey found.

For the number three executive, the comparison was 66 percent of chief executive's salary for electronics against 57 percent for all industry. And the number four man in electronics got 53 percent of head man's salary while all industry paid 41 percent.

Compensation covered in the survey also includes bonus payments, deferred salary compensation and stock options. Eighty-three percent of the electronics firms checked used stock option plans, compared to 60 percent for all industry.

SHARES and PRICES

STOCKS of nine electronics firms made their bow as publicly traded securities in the first half of 1958, as against eight for the similar period a year ago, according to recently issued tabulations of new corporate financing by Investment Dealers' Digest.

Despite depressed stock market conditions in the forepart of 1958, the nine new electronics stocks were well received. Underwriters report they disposed of all shares which had been offered for sale.

Also, recent prices of six of the nine stocks exceed prices at which they were issued. As all stocks in this group are traded over-the-counter, prices listed below are bid prices, the figures at which dealers reported they were willing to purchase these securities.

Firms which made First Public Stock Offering Jan. 1–June 30, 1958	Number of Shares Issued	Price: Date of Issue	Price: Recent Date	Earned Per Common Share[2]	Underwriting Facts: Firm	Underwriting Facts: Fee = %	Primary Field of Activity
Avionics Corp. of Amer.,[1] April 23	99,125	3.00	3.00	0.47 (year)[4]	M.D. Blauner	15.0	electronic test equipment
California Magnetic Control, Class A, June 25	110,000	2.00	3.75	0.07 (7 mos.)[5]	Holton, Hull	15.0	electroacoustics
Columbus Electronics, Jan. 7	110,000	2.50	3.125	0.20 (9 mos.)[6]	M.B. Burnside	18.0[3]	general electronic contracting
Cosmos, Industries, June 25	210,000	2.50	2.50	0.04 (8 mos.)[5]	Netherlands-J.A. Winston	18.0	navigational test equipment
Elsin Electronics, June 9	340,562	0.875	1.00	0.01 (6 mos.)[7]	Lee & Co.	13.125[8]	microwave components
J-V-M Microwave, Jan. 20	96,500	3.00	2.00	0.11 (5 mos.)[7]	Aetna Secs-Heller	15.0	microwave components
D.S. Kennedy & Co., April 9	100,000	14.50	24.00	1.21 (year)[7]	W.C. Langley	7.1	antennas
Technology Instrument, June 16	260,000[9]	9.50	8.875	1.01 (year)[4]	S.D. Fuller	10.3	precision potentiometers
Tenney Engineering, Feb. 25	99,333	3.00	6.25	0.36 (year)[4]	M.D. Blauner	15.0	environmental test chambers

[1]Formerly Jowil Electronics [2]plus option to buy 1,000 shs @ 10¢ each [3]not including new stock issues [4]ended Dec. [5]ended May [6]ended Oct. [7]ended Jan. [8]plus option to buy 18,000 shs @ 10¢ each [9]About 55,000 shares sold for company and 205,000 for selling stockholders

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- Tested to eliminate transient voltage breakdown
- Current gain: 60-120 at 5 amps; 50 at 10 amps
- Collector to base breakdown voltage: 40, 60, 80, 100 v
- 13 amps switching
- Design: ring emitter
- Standard package: plug in, diamond outline, hermetic seal
- Thermal resistance: less than 1° C/watt
- Controlled beta range: 2:1 at 5 amps

Technical Data

CTP - 1511, CTP - 1512, CTP - 1513, CTP - 1514

Absolute Maximum Ratings

Collector Current = 13 amps
Junction Temperature = 90° C
Total Power Dissipation @ 70° Mounting Base Temp. = 20 watts

ELECTRICAL CHARACTERISTICS @ 25° C

Test	Conditions	Symbol	CTP 1511	CTP 1512	CTP 1513	CTP 1514
Collector to Base Voltage (IE = 0)	ICBO = 15 mA	BVCBO	100 V (min)	80 V (min)	60 V (min)	40 V (min)
Collector to Emitter Breakdown Voltage	VBE = 0V IC = 1000 mA	BVCES	75 V (min)	60 V (min)	40 V (min)	30 V (min)
DC Current Gain	IC = 5.0 A VCE = —2.0 V	HFE	60–120	60–120	60–120	60–120
Saturation Voltage	IC = 12 A IB = 2000 mA	VCES	1.5 V (max)	1.5 V (max)	1.5 V (max)	1.5 V (max)
DC Current Gain	IC = 10.0 A VCE = —2.0 V	HFE	35 (min)	35 (min)	35 (min)	35 (min)
DC Transconductance	IC = 10.0 A VCE = —2.0 V	GFE	5.0mhos (min)	5.0mhos (min)	5.0mhos (min)	5.0mhos (min)

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MERGERS, ACQUISITIONS and FINANCE

• **Daystrom, Inc.,** diversified electronics manufacturer of Murray Hill, N. J., buys the business and assets of **Industrial Gauges,** Teaneck, N. J., for an undisclosed cash sum. Purchase also includes related patents owned by Charles B. Zimmer, IG president. The Teaneck firm makes noncontact electronic gages which use X-rays, infrared and visible light to determine density, width, diameter and other characteristics of materials. Its gages are used in the steel, nonferrous metals, chemical, petroleum, rubber and food industries. No changes are planned in management or personnel of acquired firm which will become the **Industrial Gauges Department of Daystrom-Weston Divisions.**

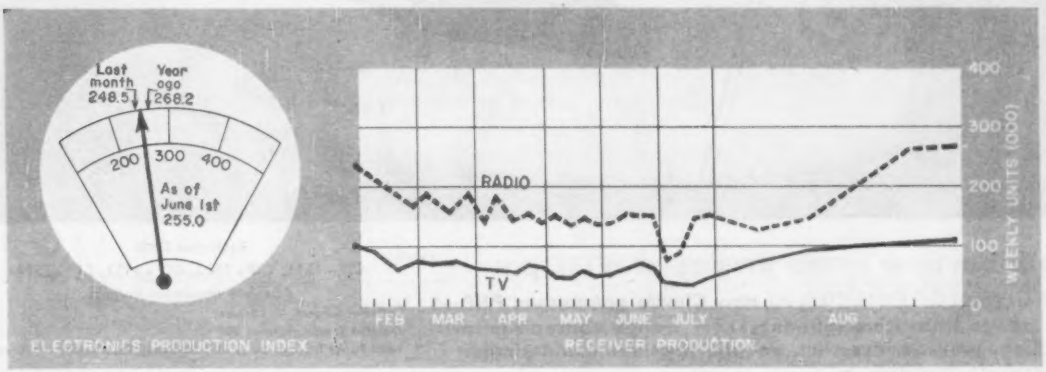
• **Solar Aircraft,** San Diego, Calif., purchases **Electronic Systems Development,** Ventura, Calif. Purchase price was not disclosed. Abilities of ESD's engineering staff are expected to be of value to Solar in the development of complex components and systems, comments Herbert Kunzel, Solar president. Ventura firm will be operated as a subsidiary of Solar and under present management.

• **Regan Industries,** San Bruno, Calif., buys the **Don-Lan Electronics** Co. of Santa Monica, Calif., for $250,000. Don-Lan makes microwave assemblies and guided missile components. It will be operated as a Regan division. Purpose of the move by Regan was to further extend its activities in the electronics field. Another Regan subsidiary, **R/S Electronics,** produces amplifier-receiver systems for use in missiles, radar systems and aircraft.

• **Magnetic Amplifiers** of New York City reports earnings for the six months ended June 30 were more than 100 percent greater than first half earnings in 1957. Firm earned $47,936 on sales of $966,812 in the 1958 period, which compares with earnings of $23,052 on sales of $746,757 in the same period of 1957.

• **Jetronic Industries of Phila., Pa.,** maker of special and general purpose precision electronic test instruments, lists common stock on the American Stock Exchage. Stock was recently traded on ASE at $6.75 per share. First public offering of stock was made two months ago at $3.75 per share. Mortimer B. Burnside & Co. and Charles Plohn, both of New York City, were the underwriters.

• **Fisher & Porter,** Hatboro, Pa., manufacturer of electrical and electronic industrial controls, plans to make Nov. 30 dividend payment in stock instead of cash. Decision was made to conserve earnings for tooling and production of new products. Net profit for year ended April 30, 1958, was $.31 per share. It was $1.62 per share for the previous year. However, firm reports substantial improvement in first quarter earnings.



FIGURES OF THE WEEK

RECEIVER PRODUCTION

(Source: EIA)	Aug. 29, '58	Aug. 22, '58	Aug. 30, '57
Television sets, total	134,921	130,556	199,954
Radio sets, total	293,771	286,656	287,190
Auto sets	68,928	80,971	83,448

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Sept. 3, '58	Aug. 27, '58	Sept. 4, '57
Radio-tv & electronics	54.62	53.29	46.50
Radio broadcasters	67.86	67.44	59.91

FIGURES OF THE YEAR

	Totals for first six months		
	1958	1957	Percent Change
Receiving tube sales	190,406,000	221,175,000	—13.9
Transistor production	18,452,324	11,199,000	+64.5
Cathode-ray tube sales	3,689,587	4,814,659	—23.4
Television set production	2,167,930	2,722,139	—20.4
Radio set production	4,961,293	7,187,294	—31.0

LATEST MONTHLY FIGURES

EMPLOYMENT AND EARNINGS

(Source: Bur. Labor Statistics)	June, '58	May, '58	June, '57
Prod. workers, comm. equip.	339,300	336,100	394,200
Av. wkly. earnings, comm.	$82.78	$80.96	$79.59
Av. wkly. earnings, radio	$82.21	$79.98	$76.97
Av. wkly. hours, comm.	39.8	39.3	40.4
Av. wkly. hours, radio	40.1	39.4	40.3

TRANSISTOR SALES

(Source: EIA)	June, '58	May, '58	June, '57
Unit sales	3,558,094	2,999,198	2,245,000
Value	$8,232,343	$7,250,824	$6,121,000

TUBE SALES

(Source: EIA)	June, '58	May, '58	June, '57
Receiving tubes, units	36,270,000	36,540,000	35,328,000
Receiving tubes, value	$31,445,000	$31,406,000	$31,314,000
Picture tubes, units	725,846	560,559	1,104,013
Picture tubes, value	$14,203,381	$11,237,147	$19,981,319

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beneficial occupancy of test sites .... is the crux of efficient missile development

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For a complete report on PAP's performance on the Atlas program, or for a prompt proposal on the services that can be supplied on other missile programs, address: Arthur P. Iacob, Executive Vice-President.

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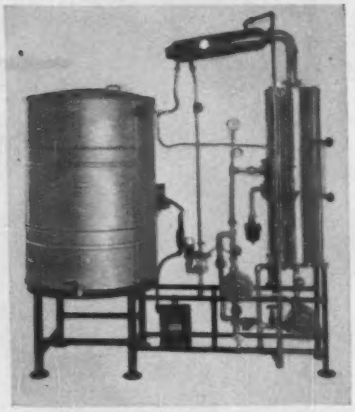

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CIRCLE 5 READERS SERVICE CARD

WASHINGTON OUTLOOK

THE PENTAGON is starting the most critical appraisal of military production and development to be made since the end of the Korean War. Goal of this appraisal is economy. It ties in with preparation of the fiscal 1960 military budget to be submitted to Congress in January. At stake is the future of all major electronics programs.

Although almost all defense budget preparations during the Eisenhower administration have been conducted with emphasis on economy, the current appraisal is the most significant to date. It comes when the adequacy of U. S. military preparedness is being questioned by critics in industry, science and politics. The questioning is underscored by Soviet successes in space, and critical political and military situations in the Middle East and the Formosa Straits.

But this current military appraisal is being made while the administration is in the middle of a drive to reduce government expenditures, trim the federal budget deficit and thus combat inflation.

The administration is in a dilemma. It must weigh economic demands against military requirements. Right now, the Pentagon's policy is to contain the rate of spending this year and to hold outlays next year to a reasonable increase (ELECTRONICS, p 12, Sept. 12).

- **Here's a summary** of electronics programs under study and the best guess on what will happen in each case:

  Air defense missiles. Production schedules for both the Army's Nike-Hercules missile, range 75 to 100 miles (Western Electric is guidance contractor), and the Air Force's 200-mile Bomarc (Westinghouse) will be trimmed well below initial plans.

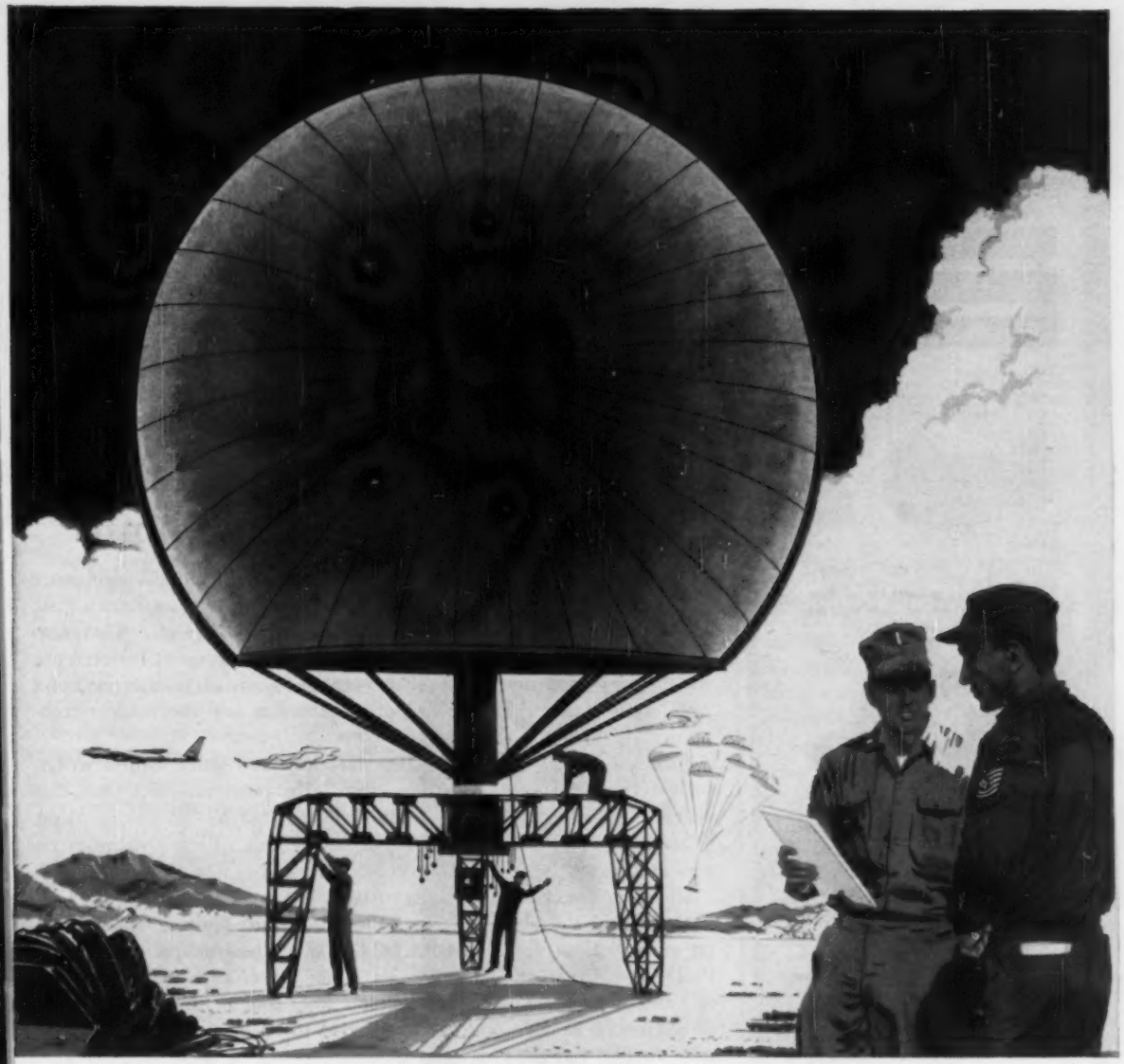
  Polaris IRBM submarines. The Navy has already put almost $1.3 billion into five IRBM-armed atomic-powered subs; North American's Autonetics Division inertial-guidance system has recently been adopted for the subs. GE is guidance contractor for the Polaris missile. Congress voted funds for four more vessels and stepped up missile output. The Navy may seek still more money next year. The Pentagon, however, will not go beyond the present schedule until the system has been more thoroughly tested. First test firing comes early next year; important engineering changes are in the works for the subs.

  IRBM's. Production of both the Air Force Thor (AC Sparkplug) and the Army Jupiter (Ford Instrument) is still underway at an extra production cost of at least $100 million monthly. Tentative plans are for three Jupiter squadrons and seven Thor units. The decision to wash out one of the projects will be made shortly. Thor's production rate is now double Jupiter's.

  ICBM's. Atlas will continue on a full-speed basis (GE and Burroughs are guidance contractors) with the Arma gear designed for the later Titan missile now being incorporated into Atlas. Titan won't be pushed as fast.

  B-52 bombers. The Air Force pleads for a thirteenth wing. Production is now scheduled into early 1961, bringing total planes ordered to 642. Odds are against additional production.

  Army ground communications. The Army seeks greater funds than last year's $200 million program, is unlikely to get them.



Have Radar—Will Travel

"Paraballoon" antenna folds up, flies to the fight. It's magnesium light.

Take a high-powered radar installation, and design it with magnesium so it can be assembled and disassembled easily, and toted around from place to place.

That's just what Westinghouse did when it developed the "Paraballoon" antenna for the Air Force. This highly mobile radar unit weighs just 1,730 lbs. compared to 10,000 lbs. for its comparable heavy metal counterpart. It can be taken apart by its crew in minutes, packed in 200-lb. containers, airlifted to a new location and put into action immediately.

Wondering why the "Paraballoon" antenna can do such a big job, yet weigh so little? The unit is constructed almost entirely of lightweight, rugged magnesium alloy. The reflector platform is magnesium sheet and extruded channels. The turning tube is a magnesium sand casting and the tripod is welded magnesium tubing. The radar reflector is a fully deflatable fiber glass balloon.

The "Paraballoon" antenna is one of the many examples of how the high strength-to-weight ratio of magnesium pays off in terms of saved weight in electronic equipment. For more information on magnesium in electronics contact the nearest Dow Sales Office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1416N-1.

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CIRCLE 8 READERS SERVICE CARD

Fisk: Yankee at the summit

HEAD of the U. S. delegation to the recent Geneva technical conference on methods of policing a ban on nuclear tests was James Brown Fisk, executive vice president of Bell Telephone Laboratories. That anything constructive came out of this "scientific summit" conference was due in large measure to Fisk's patience, unfailing courtesy, and well-founded understanding of both electronics and the nuclear technology.

Fisk is a typical New Englander: he's lean and quiet, almost irritatingly tolerant of other people's views. He possesses—and uses—the characteristically dry, incisive humor. Born close to the soil in West Warwick, R. I., on Aug. 30, 1910, he still retains a deep love for green growing things.

His early career was largely scholastic. He took his B.S. at MIT in 1932, became a Proctor traveling fellow at Trinity College, Cambridge, for two years, then returned to MIT as a teaching fellow to take his Ph.D. From 1936 to 1938 he was a junior fellow in Harvard's Society of Fellows. The following year, after a brief tour as associate professor of physics at North Carolina, he decided to try his wings in industry, went to Bell Labs.

During the war he headed the magnetron development group at the Labs, later took charge of electronics and solid-state research. In 1946, he became the Atomic Energy Commission's first director of research, returned to Mother Bell in 1949 to take charge of all research in the physical sciences. He became research v-p in 1954, took over his present responsibility a year later.

He now serves as one of two deputies to Presidential Science Advisor J. R. Killian, is still a member of AEC's general advisory committee. The small fragments of time left over he invests in his home and family. He married a Massachusetts girl in 1938, has three sons. He likes to work on his New Jersey farm; he feels that farm work gives him a respite from arduous scientific concentration, helps him maintain his equilibrium and sense of proportion.

COMMENT

Profit and Property

It's good to see that the Justice Department is going into action on behalf of defense contractors hit by state and local tax suits (Washington Outlook, p 8, Aug. 22). State and local authorities all too frequently look on industry as a source of easy money, and

the Supreme Court's ruling (that property owned by the Federal government and used by private companies for profit is not immune from local taxes) did nothing to ease the situation.

N. K. Adams
Birmingham, Ala.

Martian Chronicle

Has your proofreader signed a statement of loyalty to the United States government? If not, he might be a Martian spy.

The 8th line in the item "Use of Nuclear Radiation . . ." (Engineering Report, p 20, Aug. 22) was most *unclear*. It could pass for some form of code, communicating classified ideas on unclear energy to the flying saucers.

Translation, please.

R. L. Chamberlain
Seattle, Wash.

The offending sentence reads:

". . . which is conducting a techni-tions of high-levelhr hrd hrd hrd hrd hrd rdlhum-cal high-level radiation . . ."

The Martian consul in New York tells us that it was received in the flying saucers in its correct form, viz.:

". . . which is conducting a technical and management study of industrial applications of high-level radiation . . ."

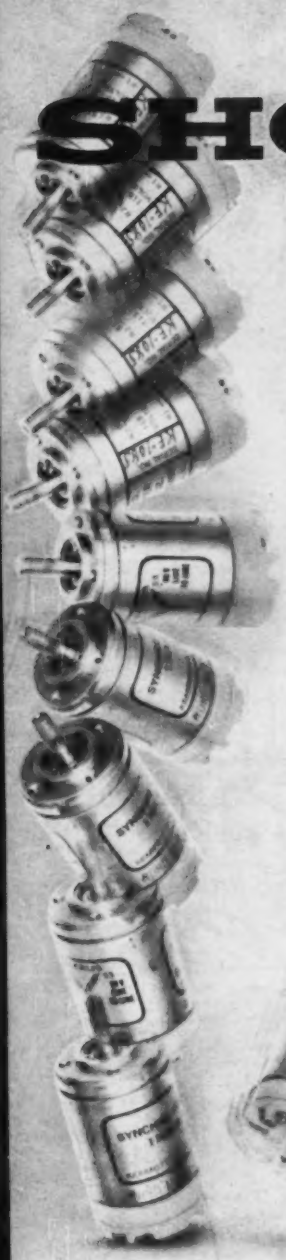
High-Level Telecast

In connection with the account "Navy Telecasts From 82,000 ft" (p 8, Aug. 15), it could be inferred that the role of the Naval Air Development Center at Johnsville, Pa., was limited to the modification of a standard radar set. Actually, the equipment used was a radar relay transmitter which had originally been developed at this Center. The modification made for balloon operation was limited to supplying the primary power from the available balloon source.

The personnel at this Center are proud of their development of the complete transmitter.

Henry Suter
U. S. Naval Air Development Center
Johnsville, Pa.

Precision Components...another Kearfott capability.



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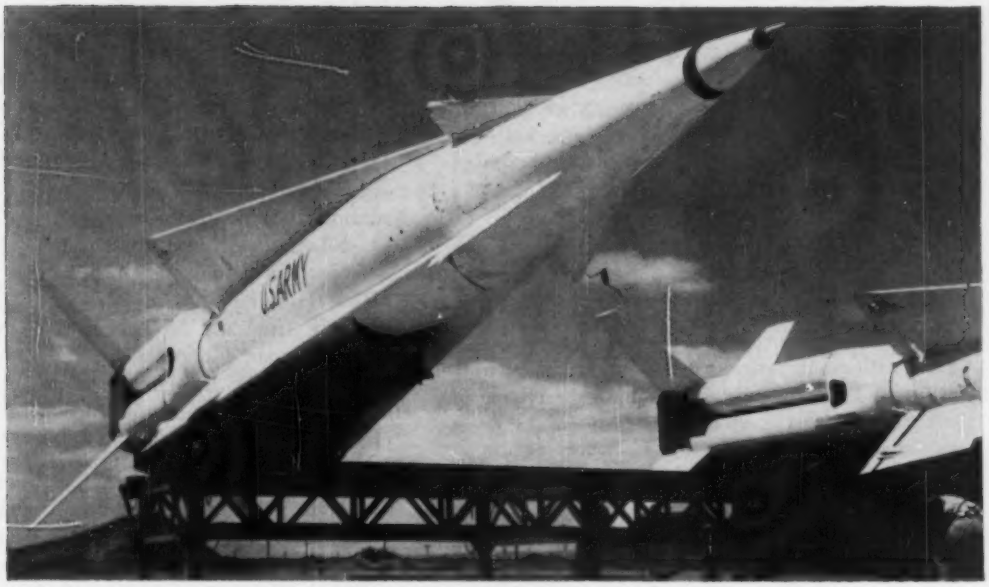
electronics
business issue
SEPTEMBER 19, 1958



Nike Hercules starts moving in to launching sites this month as . . .

Interceptor Missile Pile Grows

A multibillion dollar market for electronic missile gear lies in goal of a 60-percent missile and 40-percent manned-interceptor air defense force by the mid-1960's for North American Air Defense

THE GROWING FAMILY of surface-to-air guided missiles, operated by the Army, Navy, Marines and Air Force, for land and fleet defense, will bring in over a billion dollars to our industry in fiscal 1959.

Army has requested authority to obligate $430 million during 1959 for the airborne portion of its four surface-to-air antiaircraft missile systems: Nike Ajax, Nike Hercules, Hawk and Talos. Actual expenditure, however, will far surpass this. For Nike Ajax and Nike Hercules alone, estimated payments during 1959 on contracts placed in previous years will amount to $477.2 million, and in 1960 payments on these same pre-1959 contracts will take $66.8 million. Continual obligations of new monies out of the $430 million for the current fiscal year will keep overall expenditure figures rising.

Pre-1959 contracts for Hawk to be paid off in 1959 amount to $33.6 million. In 1960, $1 million will still be due. Ground equipment for Hawk, contracted before 1959, will require $13.8 million in payments this fiscal year, and $3.9 million in 1960.

Total already spent for radio command guidance systems and other electronic gear for more than 100 Army Nike launching sites has not been released by the Pentagon. Equipment at each site includes three radars, a computer, automatic plotting boards, 12 launchers, test and checkout gear. All sites are currently being equipped with more powerful radar to handle the longer-range Hercules. Stockpiling of Hercules begins this month.

Navy is authorized to obligate $371,914,000 in fiscal 1959 for airborne portion of Bumblebee family of missile systems: Talos, Terrier and Tartar.

Though Navy will not release figures for shipboard gear, the amount probably exceeds that of the actual missiles.

Sperry Gyroscope alone has announced $136.8 million in contracts over the past 12 months for ship-

board guidance for the Terrier and Talos missiles.

USAF's Bomarcs, A and B, will get $814,600,000 in procurement appropriations for missiles and ground support equipment for fiscal year 1959. USAF says probably only $730 million will be obligated during the year. Appropriations for the 14 planned launching sites will be separate.

Of particular interest to the electronics industry—both from the standpoint of sales and technical achievement—is guidance. The variety of guidance systems being used has almost kept pace with the number of missile models. Seven system combinations are now employed in 10 missiles (see chart).

Beam rider uses three ground radars: one to acquire the target and pass it on to a second, narrow-beam radar for tracking, and a third to guide the missile on an intercept course to the target.

Beam rider has several disadvantages: accuracy decreases with range; range is limited by the radar horizon; ground station must always have direct line of sight to the target; and if more than one target is handled, multiple radars must be used. However, more than one missile can ride a beam to one target.

Three missiles use the beam rider technique:

Navy's Terrier (cover photo) relies on beam rider all the way to the target. Results, Navy reports, are highly satisfactory. Navy's Talos rides to the target area by beam then switches on its own radar transmitter to home in on the signal echos received from the target. Army's Talos—only one prototype of this land-based version exists—starts on a beam, homes in via a semiactive radar homing technique.

(As in active radar homing, a receiver in the missile homes in on echos received from the target. The difference between active and semiactive homing lies in the source of target illumination. Active systems carry their own radar transmitter. Semiactive systems rely on ground radar to keep the target covered.)

Radio command uses three ground radars: One acquires the target and passes it on to a tracking radar. A third radar tracks the missile. Data from both tracking radars are fed to a computer which solves an intercept problem. Steering instructions are sent to the missile by communications link.

Airborne gear is relatively simple: a receiver actuates servo systems that drive missile controls.

Five interceptor missiles use radio command:

Marines' Terrier, Army's Nike Ajax and Hercules are guided solely by radio command. USAF's Bomarc A and B get to the target area by the SAGE radio command. Both home in on the target by terminal systems—A by active radar homing and B by still-classified "improved terminal guidance."

Semiactive homing is the sole guidance used by Hawk (Homing All The Way Killer), being bought by both Army and Marines, and by Navy's Tartar. Ground radar pinpoints the target. Receiver in the missile picks up reflected signals, before launching or soon after, and homes in all the way.

Advantages of semiactive homing over active: absence of a transmitter in the missile results in greater simplicity, less weight and cost. The transmitter, being on the ground, can be much larger, stronger than one in a missile. This fact adds range.

One disadvantage is that the ground radar must continually maintain line-of-sight with the target.

Passive homing is still another terminal guidance possibility. As in a semiactive system, the missile will carry a sensor, receiver, computer and vehicle control mechanisms. Energy picked up from the target originates at the target itself. This may be ultraviolet, infrared, radio, nuclear phenomena, magnetic effects and others. Absence of all radar, either in the missile or on the ground, results in a less complex as well as silent system. Disadvantages include problem of detecting the energy, atmospheric attenuation of energy and obtaining range data.

GUIDANCE SYSTEMS IN SURFACE-TO-AIR ANTIAIRCRAFT MISSILES

Missile	Service	Range	Propellant	Guidance Contractor	Prime Contractor	Launcher Contractor	Air Frame Contractor	Status
Beam Rider								
Terrier	Navy	10 mi	solid	Sperry	Convair	Northern Ord.	Convair	op. on 3 ships; 34 by 1963
Beam Rider plus Active Radar Homing								
Talos	Navy	25	solid/ramjet	Sperry/Bendix	Bendix	Northern Ord.	McDonnell	op. on 1 ship; 9 by 1963
Beam Rider plus Semiactive Radar Homing								
Talos	Army	25	solid/ramjet	RCA/Bendix	Bendix	Am. M. & F.	McDonnell	evaluation
Radio Command								
Terrier	Marines	10	solid	West. Elec.	Convair	Maxson	.....	op. two battalions
Nike Ajax	Army	50	solid/liquid	West. Elec.	West. Elec.	Douglas	Douglas	100 sites now defend 15 areas
Nike Hercules	Army	100	solid	West. Elec.	West. Elec.	Consol. West.	Douglas	op.
Radio Command plus Active Radar Homing								
Bomarc A	USAF	200	liquid/ramjet	Westinghouse	Boeing	Burns & Roe	Boeing	prod.; 14 sites planned
Radio Command plus ? (Unknown)								
Bomarc B	USAF	400	solid/ramjet	Westinghouse	Boeing	.....	Boeing	development
Semiactive Radar Homing								
Hawk	Army/Marines	22	solid	Raytheon	Raytheon	Northrop	Northrop	op. in fiscal 1959
Tartar	Navy	10	solid	Raytheon	Convair	Convair	Convair	dev.; to be on 23 ships by 1963

Op. = Operational **Prod. = In Production** **Dev. = In Development**

Radio Crashes Iron Curtain

Soviet bloc ground and sky-wave jamming of U. S. public and private broadcasting costs over $100 million a year but still the truth gets through. Voice of America plans 12 new transmitters

WHEN the Voice of America went on the air last month to broadcast the proceedings of the UN General Assembly meeting on the Middle East directly to the Soviet bloc, the Russians were ready. They used 2,000 to 2,500 jammers to blot out all 16 frequencies used by VOA.

Soviets use two types of jamming:

• **Low-power ground jammers.** These are the most numerous. They are used in metropolitan areas like Moscow and Kiev. They ring cities and even areas as small as a city block or a single apartment house. Their power is dissipated in a small area.

• **High-power sky-wave jammers.** These cover the wide open spaces between metropolitan areas, are similar to medium-wave broadcasts. Soviets also use them unsuccessfully to try to blot out VOA shortwave feeder signals from the U.S. before they reach relay stations overseas.

Cost of this Communist jamming effort: well over $100 million is the "conservative estimate" of the U. S. Information Agency.

Jamming is counteracted a little by brute force, somewhat by high-gain antennas, but mainly by saturation broadcasting on many frequencies at the same time, with repeat broadcasts at different hours.

Also used: the "cuddling" techniques of broadcasting on frequencies close to those used by the Communists for domestic purposes on the theory that if they jam the Western broadcast, they'll also blot out their own.

So elaborate is the Soviet jamming system that it requires communicating of individual station identification and instructions. Each Soviet jammer has a two-letter code or a letter-number designation. Single jamming network covers the entire Soviet bloc in eastern Europe, with much of the sky-wave jamming of programs beamed to satellite countries done from Russia.

Voice of America

Voice broadcasts originate in Washington studios, go to seven feeder bases in the U. S., then by shortwave to relay stations at 10 overseas locations. There, transmitters boost the shortwave signals to target areas. Broadcasts are also recorded for later repeat patterns and simultaneously broadcast by long-wave and by medium-wave transmitters.

Most broadcasts to the Soviet bloc are short-wave, since about 75 percent of the radio sets in that part of the world are estimated to be equipped with short-wave gear.

Three-year, $27-million VOA expansion program is underway which includes these plans for Soviet bloc broadcasting:

• **$10 million recently voted by Congress to expand the VOA's East Coast broadcast facilities. This would include six 250-kw and six 500-kw transmitters, enabling programs to be beamed directly into the Soviet orbit from the U. S. without relay stations, and would lessen the effectiveness of Soviet sky-wave jamming.** Right now, VOA uses one 100-kw and 12 50-kw transmitters in the U. S. When sites for new stations are chosen, specifications will be drawn and a contract for the equipment will be let out on a bid basis.

• **Not-yet-approved Project Sahara.** This would improve VOA shortwave reception in eastern Europe and the Soviet Union, probably involve a 500-kw relay station.

VOA broadcasts in a total of 43 languages, including three Chinese dialects. Three-fourths of its direct daily short-wave broadcasts, totaling 40 hours, are aimed at Communist countries. They are repeated an additional 85 hours to counteract Soviet jamming efforts.

Radio In the Allied Sector

U. S. Information Agency also operates RIAS, a station in West Berlin. Although RIAS relays some VOA transmissions, about 97 percent of its programs are set up by its own staff. It broadcasts 24 hours a day to East Germany on a 20-kw short-wave transmitter, two 150-kw medium-wave transmitters (combined at night); one 20-kw and one 40-kw medium-wave; and uses the VOA megawatt long-wave transmitter at Munich. RIAS is also using powerful f-m transmitters.

Radio Free Europe

Radio Free Europe, whose financial support comes from annual fund-raising by Crusade For Freedom, broadcasts daily to Poland, Czechoslovakia, Hungary, and Rumania and Bulgaria. RFE transmits to target areas from Biblis, near Frankfurt, West Germany, using: two 50-kw RCA, one 50-kw modified Brown-Boveri, one 20-kw B-B and four 10-kw B-B transmitters, and from a 135-kw medium-wave trans-

mitter at Holzkirchen.

From Holzkirchen six more 10-kw Brown-Boveri's carry programs to Portugal. Reason: To use the higher frequency broadcast bands down to the 13-meter band, the transmitters must be farther away in order to hit the satellite targets. Hence, at Gloria, Portugal, RFE has four 100-kw GE transmitters, eight 50-kw RCA's and one 10-kw RCA aimed at the satellites. Antenna gear: stacked collinear arrays on shortwave, with some rhombics used occasionally, and 4-tower directional array on medium-wave.

Communist jamming, says RFE, comes from skywave transmitters of all sizes concentrated mostly in western Russia. Large ground jammers are located in cities such as Prague and Bucharest. A 5-10 kw jammer, which might be typical, is usually effective within 15 miles.

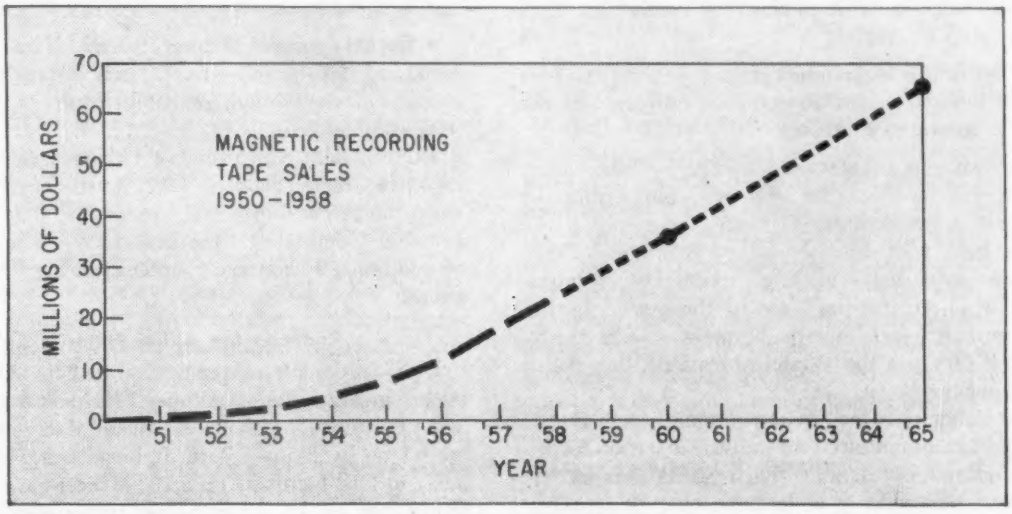
Polish language broadcasts, reports RFE, are not jammed from within Poland. It appears that the Polish government has expanded its own broadcast services with the money that would otherwise be spent on trying to jam seven RFE frequencies. Cost to Poland was estimated at $17 million annually in 1956 when Polish jamming stopped.

Radio Liberation

Near Mannheim, in West Germany, curtain antennas fill a field like giant goal posts and badminton nets. They are activated automatically, and permit nine radio transmitters to broadcast to the Soviet Union, sole target area for Radio Liberation. Five other RL transmitters on Taiwan beam broadcasts to Siberia. This voice of The Committee for the Study of the USSR is privately financed by foundations and individuals.

Radio Liberation's transmitters in West Germany include: four French Thomson-Houston 50-kw shortwave transmitters; three pairs of 10-kw Brown-Boveri transmitters in parallel, a 20-kw Brown-Boveri and a 20-kw Gates transmitter. From Taiwan RL blankets part of Siberia with two GE 25-kw shortwave transmitters, a 50-kw Standard transmitter and a 20-kw Telefunken transmitter.

PRODUCTION and SALES



Tape Sales Increase 33% to $24 Million

PRODUCTION of magnetic tape will climb to about $24 million in 1958, up one-third over last year's $18 million. At present rate of gain the tape market will pass $50 million in the early 1960's and could reach $100 million by the end of 1970.

Instrumentation tape, used in computers, data processing and telemetering, accounted for about 40 percent of all last year's tape sales. It is the fastest rising portion of the magnetic tape business. Audio tape represented 60 percent of total tape production, $10.8 million. Quarter-inch audio tape led because it includes tape for the huge home market. A smaller part of the audio tape market includes tape for broadcast use.

Industry sources believe that over half a million home tape recorders were sold last year, almost half of them for stereo. Recent development of the new slow-speed (3¾ ips) four-track tape greatly expands this market. Video tape, two inches wide and costing several hundred dollars per reel, makes up less than one percent of production this year. But this use will grow rapidly as tv switches from film.

How to Hire Sales Engineers

Here's one way sales managers seeking men can evaluate a large field of candidates. It saves time, and wear and tear on vocal cords. And more vital, it helps firms prepare for expected selling boom

CHICAGO—PROMPTLY at 7 one evening last week half a hundred men (average age: 34) settled back in a downtown hotel suite here as the sales managers of six electronics companies each related what his firm offers sales engineers and, conversely, what his firm requires of its sales engineers.

The meeting, one of eight Sales Forums conducted over a 20-month period, was held to give prospective employers the chance to meet sales engineering candidates en masse. The Forums are run by Tom McCall & Associates, an employment group, in cooperation with several electronic and other technically based manufacturing firms.

By 9 p.m. the employers had completed their presentations and the applicants were meeting company representatives with whom they had elected to have five-minute discussions.

To be invited, each applicant had to have the minimum experience qualification for at least one of the half dozen companies represented. Generally, applicants (85 percent of whom were already employed) said they wanted "a more challenging situation". The rest of the men were unemployed.

Employment agency executives feel that attendance of 85 percent employed applicants reflects the upturn in business through the men's willingness to consider change. This inclination to change jobs in the electronics sales field has been somewhat lacking in recent months.

The median salaries reported were from $8,000 to $10,000. Some men, however, were said to have taken as little as $500 per month initially when hope was extended that they might eventually raise their incomes to as much as $13,000 annually.

Idea of the meetings is to economically expose a large number of prescreened applicants to the requirements of employers and give the applicants a chance to ask specific questions about the companies. The men, by this method, meet with employers whom they probably would not have seen if they tried to gain entrance with only a résumé. Applicants are offered the opportunity to display what they have in the way of personality and appearance.

The employers are offered the opportunity to tell their stories once to between 50 and 80 men, instead of repeating the company's story over and over in individual interviews.

Each applicant also receives a quick idea of his own marketability by exposure to the requirements of several companies. Each employer gets a clear picture of how the opportunities he offers compare in today's market with those offered by similar companies.

At one meeting held a short time ago, 79 sales engineer applicants heard five-minute presentations by each of seven employers. At this forum, a total of 120 five-minute screening interviews were completed.

Of this number, 27 applicants were invited to meet with employers later for a more comprehensive interview.

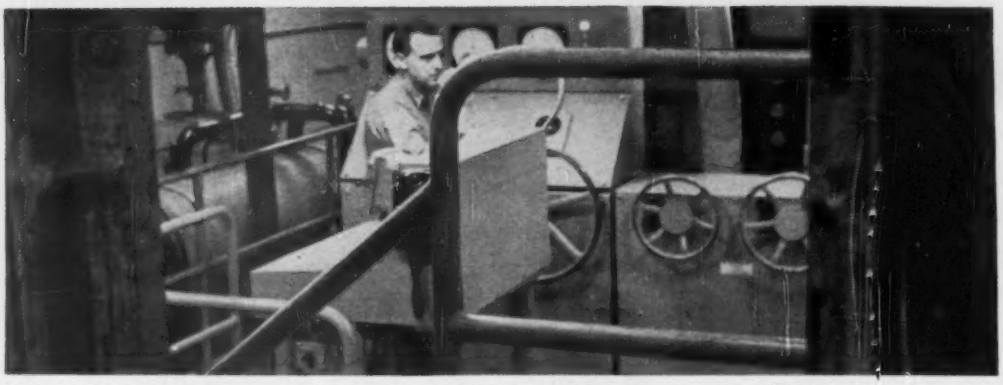
No résumés are presented to prospective employers at the meeting until after the potential employee and employer have met. The different speakers, usually sales managers, are requested to quote salary ranges.

Results of the eight meetings over more than a year and half show some striking points:

- Most unemployed sales engineers were in the upper-age brackets.
- Employers usually felt younger men have greater adaptability.
- Companies did not want to hire men older than the men they will work for.
- The sales engineers sought new jobs for better salaries; not necessarily immediate money hikes, but greater dollar potential over the long run.
- Employers usually give an employment agency ideal requirements, then hire men who meet only minimum requirements.

Here are two factors that made sales engineers want to change jobs:

"Had not been given a feeling of importance in present job." "Had not been helped enough by management for maximum effectiveness as sales engineers in present jobs."



Controls for twin-reactor power plant, only a small part of the electronics aboard U. S. Navy's new . . .

Undersea Radar Station

"PRIMARY ARMAMENT" of the new-launched nuclear submarine *Triton* will be radio, radar and television. That's the statement Adm. Jerauld Wright, commander-in-chief of the U. S. Atlantic Fleet, made at the launching.

The ship, largest submarine ever built (she's 100 ft longer than many destroyers), will serve as a radar picket. Actually, she carries all the radar of a picket destroyer, plus the conventional sonar, navigating and fire control gear of a nuclear submarine.

She will serve as an early-warning post for the fleet. General Dynamics' Electric Boat division, which built the submarine and is now outfitting her, figures that she may be the only one of her class (cost: $109 million) but that some of the tricks learned in putting her together will help in building the ballistic-missile submarines.

Long-range radar aboard the *Triton*, like much of Navy's electronics, is assembled into final systems by the Navy itself. The transmitter will have a range upwards of 500 miles, will be primarily for antiaircraft work rather than antimissile detection. Effective coverage will be extended by air early warning (AEW) planes which will fly in advance of the ship and relay radar data back. Time-division data-link will carry the data from air to sub, where it will be displayed on ppi consoles in the ship's combat information center.

Triton is big enough to contain a full-scale CIC amidships. Here the radar data will be displayed for the fire-control officers who direct and control the intercept activities of fleet fighter planes.

The score or more radar and radio antennas she carries will sink into her sail (70 ft long, 18 ft abeam and 34 ft high) while she's submerged, be elevated into place when she goes on station.

The sub's fire-control center will use its own and the remote data to figure out total air, surface and subsurface tactical situation. *Triton* will carry equipment (similar to the controls for true-position radar) which will use dead-reckoning information and ship-to-plane parallax corrections to let a console operator see the ppi picture from the sub's point of view, from the point of view of the AEW plane, or from some third, arbitrary, viewpoint.

An EB engineer comments "*Triton*'s heavy in both radar and communications gear—the latter because of relay requirements, both from AEW planes to sub and from sub back to the fleet."

She also packs a whale of a lot of active and passive electronic countermeasures and recon gear, may find valuable employment as a fixed listening post for transmissions originating behind the Iron Curtain.

Triton's twin water-cooled reactors were built by General Electric's Knolls Atomic Power Laboratory in Schenectady, N. Y. Instrumentation for control of the reactors is focused in the water jacket which cools the pile; the temperature, flow and pressure of the water provide sufficient data to control the reaction.

The "scram" control, which shuts the reaction down in emergency, is purposely not electronic. It is spring driven, and held open by solenoids, so that in any power failure the reactor fails safe.

Triton is the first nuclear submarine that can be refueled without tearing open the hull. A small hatch in the hull, coupled with the unit-cell construction of the reactor core, permits a saving of about four weeks in refueling time and allows the ship to refuel at sea anchorage if necessary.

Triton is also the first three-deck submersible, and the first to use a 40-line telephone switchboard. The board was built by Stromberg-Carlson, replaces the traditional mare's nest of sound-powered communications.

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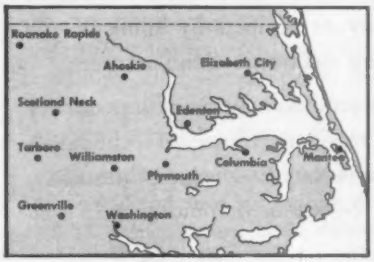

North Carolina's great historical romancer, Inglis Fletcher, tells how land records were kept in colonial days. "Each year, the old men showed the boundaries as they remembered them to younger men. They, in turn, showed the lines and marks to youths of sixteen and seventeen . . ." And the ceremony ended in feasting and dancing under the stars.

Today, these same lands, in North Carolina's northeastern corner are among America's choicest industrial locations. For the State is rich in resources. It's among the top four producers of mica, talc, titanium and ten other important minerals. Its forests hold vast reserves of hard and soft wood. Its farms yield abundant agricultural products.

North Carolina has what you need. Manpower? The state home-grows two workers for every one who moves or retires. Transportation? Three major railroads and many truck lines serve this area, which lies close to the great ports of Hampton Roads. Electric power? VEPCO's generating capability of 1,531,900 kilowatts will reach 2,171,900 by 1960!

For confidential site-finding help in this land of mild climate, fine water, friendly people and government . . . contact VEPCO, serving "The Top of the South" in North Carolina, Virginia and West Virginia.

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ENGINEERING REPORT

Aircraft Controls Share Computer

AIRCRAFT CONTROL SYSTEM using a single digital computer was outlined yesterday at the Instrument Society of America's annual conference. Philco disclosed its Transac C-1100 can be programmed to compute speed and other air data; autopilot operation; engine cruise control; inertial, VORTAC and dead-reckoning navigation; intercept, weapons delivery, landing and diagnostic check. The various systems, now tied to individual computer units, will share the Transac's time. Time-sharing is possible because the computer can perform 60,000 additions, or 15,000 multiplications, divisions or square roots a second, including memory access time. Transistorized unit weighs 100 pounds and occupies two cubic feet. At the same meeting Lewis Flight Propulsion Lab reported that its test instrumentation facilities also feature time-sharing of a central digital computer. Part of the system generates computer programs for specific tests; computer provides outputs specified by the test engineer.

PRICE OF LEADERSHIP in space exploration is double the half billion dollars budgeted for the National Aeronautics and Space Administration, Dr. Hugh L. Dryden told ELECTRONICS. The deputy director of NASA also urged recently that the U.S. put exploratory probes "out near Mars and Venus," said it's "something we should do now." He indicated that space travel would probably start with "man going around the earth once or twice, a program which is a simple goal." However, greater reliability is first necessary, said Dryden. "When we will achieve this greater electronic and mechanical reliability we don't know." Among the problems facing NASA, he reports, are midcourse and terminal guidance.

SOVIET COMPUTER CENTERS will be transformed into a single state system, it has just been learned. Victor Alexandrov, head of the design bureau of the USSR State Planning Committee, is quoted in a Soviet publication as stating: "As long as we cannot provide all the consumers with computers, we must concentrate on using available machines as effectively as possible. This means concentrating on the buildup of large computing centers and the urgent task of transforming them into a single state system."

THREE EARTH SATELLITES fired under international auspices and equally spaced in an equatorial orbit around the earth could relay uhf communications signals to and from most points on the earth's surface. Such a plan was recently outlined by Richard S. Cesaro of the Advanced Research Projects Agency. But legal controls such as the allocation of frequencies must first be established on a national and international basis, he said. Other possibilities for such a network: to carry out world-wide weather observation, perhaps even as part of an international weather control system; to observe and control space traffic electronically.

TECHNICAL DIGEST

• **Automatic** optical gaging is achieved by mounting lead sulfide photocells on screen of optical comparator in production equipment made by Automation Gages. Machined parts are brought into light beam by conveyor or turntable and greatly magnified image is projected on screen. Appropriately positioned photocells sense whether contours are within predetermined tolerance limits, then activate sorting gates.

• **Passive** range-measuring system for determining distance between two aircraft requires only that second aircraft be transmitting distinctive radio or radar signal for conventional navigation, altitude determination or radar detection. From measurement of time interval between reception of direct signal and that reflected from ground, angle of arrival of direct signal, and altitude above ground reflection point, range can be computed automatically for collision prevention purposes, according to U. S. patent 2,837,738 assigned to Fairchild Engine & Airplane.

• **Brownish** organic deposits on nonarcing palladium contacts of relays, causing mysterious transient opens, have been traced by Bell Labs to low concentrations of vapors of phenolics and a wide variety of other organic materials. Sliding friction of contacts causes frictional activation and polymerization of chemisorbed layers on the palladium. Recommended solution is 1-mil overlay of gold, containing 8 percent silver, on 9-mil palladium base.

• **Rolled** triangular antennas, resembling uhf fan or butterfly versions when unrolled and dipoles when rolled, gave wide-band characteristics of fan antennas in tests at Tohoku University, Japan, but had much better mechanical stability. Bases of triangles can be at outer ends or can be facing each other at twin-lead connection points. Spiral metal layers do not touch.

• **Dust-iron** slug directly behind tuning piston of coaxial microwave hardware minimizes r-f leakage past piston. In one Mullard version, slug is hollow cylinder inside calibrated piston-adjusting spindle.

Liquid Cools Inertial Components

FLOWING liquid is being investigated as a means of controlling the temperature of inertial guidance components at MIT Instrumentation Laboratory. The work is described by Francis Associates, Consulting Engineers of Marion, Mass.

A system was developed that is capable of controlling the temperature of liquids to within 0.01 F at flow rates from 0.02 to 0.1 gpm or greater.

Since in this application heat is dissipated in the controlled component, heated liquid controlled to an accuracy of 0.15 F is added to the cooler liquid returning from the component. Close control is achieved by sensing the temperature of the mixed liquid and using the transducer signal from the sensor to drive a servo valve that determines the rate at which the hot liquid is added.

To further ease the temperature control problem, only about two percent of the total liquid in the system passes through the component being controlled. In this way, temperature changes of the component have a limited effect on the large amount of liquid. The liquid not passing through the component is shunted through a bypass.

Temperature of the hot liquid supply is maintained in a reservoir by a large area heater and a motor-driven agitator. Temperature of the liquid in this part of the system is kept at about 10 F above the desired component temperature.

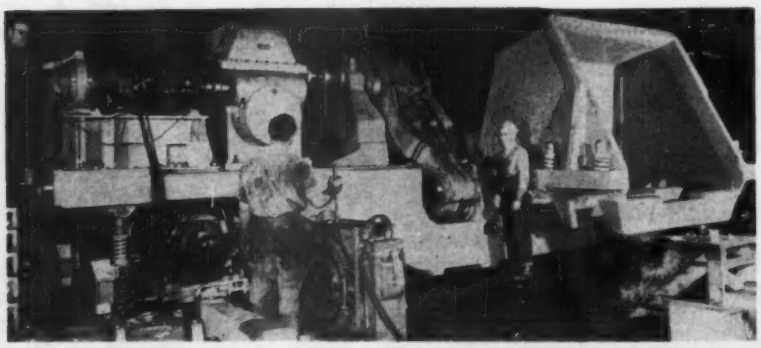
Heavy insulation is used in the component branch of the loop to prevent temperature drop between the point of mixing and the component. However, the bypass branch is left partially uninsulated to ensure that sufficient heat is lost for the control system to function properly. A specially designed mixing chamber is used to ensure adequate mixing of the returned liquid with the hot fluid released from the servo valve.

The temperature sensor used to control the servo valve is a disk thermistor. Its resistance is approximately 300 ohms at the normal control temperature of 145 F. It is used as the active arm of a resistance bridge that produces a voltage output. A temperature change of 0.001 F produces a change in output of about 200 microvolts.

Valve position feedback is provided by a 25,000-ohm, 10-turn potentiometer mechanically coupled to the valve shaft and connected into the bridge circuit. At maximum sensitivity, the dead zone of the valve is approximately ± 4 degrees of shaft rotation or 50 microvolts. This represents a temperature error of approximately 0.0002 F.

Bridge output is fed to a chopper-stabilized d-c amplifier. D-c amplifier output, applied through magnetic amplifiers, drives the 28-volt servo valve motor. Loop gain is slightly over 60 db.

Electronic Ingot Buggy



High-frequency carrier system is used in electronic control for cast steel ingot pot car. Built by Blaw-Knox, it will be used at Kaiser Steel Co. in Calif. Two 100-hp motors drive car, which will be positioned automatically at soaking pits and mill receiving table

MEETINGS AHEAD

Sept. 22-24: National Symposium on Telemetering, Americana Hotel, Miami Beach, and Patrick Air Force Base (Sept. 25).

Sept. 24-25: Industrial Electronics, Seventh Annual Conf., IRE, AIEE, Rackham Memorial, Detroit, Mich.

Sept. 25: Engineering Problems in Space Medicine, IRE Medical Electronics, Univ. of Penn., Phila., Pa.

Sept. 26-27: Broadcast Transmission Systems, Annual Symposium, IRE Prof. Group, Willard Hotel, Wash., D. C.

Sept. 29—Oct. 3: Audio Engineering Society, 10th Annual Conv., Hotel New Yorker, N. Y. C.

Oct. 1-2: Radio-Interference Reduction, U. S. Army Signal Research & Devel. Labs, IRE, Armour Research Foundation, Chicago, Ill.

Oct. 6-8: Symposium on Extended Range and Space Communications, IRE and George Washington Univ., Lisner Auditorium, Wash., D. C.

Oct. 13-15: National Electronics Conf., 14th Annual, Hotel Sherman, Chicago, Ill.

Oct. 20-21: Aero Communications Symposium, Fourth National, PGCS, Hotel Utica, Utica, New York.

Oct. 20-21: USA National Committee, URSI Fall Meeting, Penn State Univ., University Park, Pa.

Oct. 26-31: American Institute of Electrical Engineers, Fall Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.

Oct. 29-30: Fifth Annual Computer Applications Symposium, sponsored by Armour Research Foundation, Morrison Hotel, Chicago, Ill.

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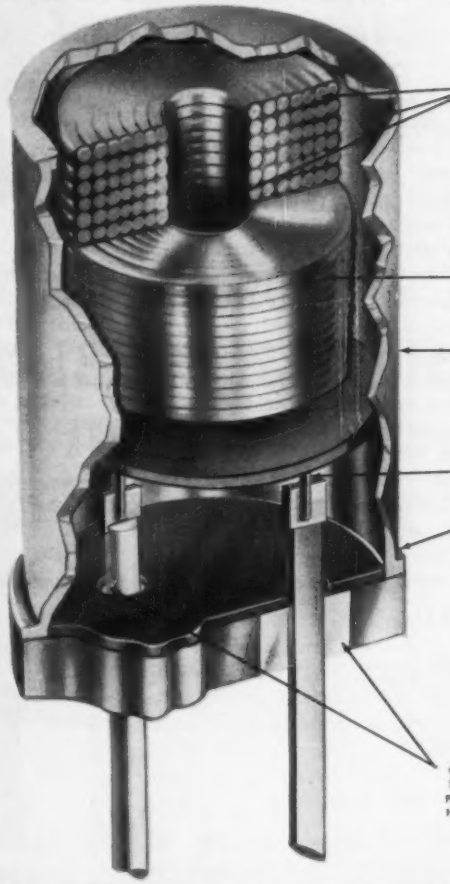
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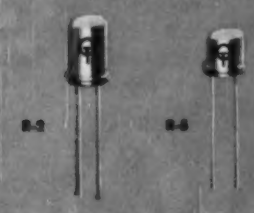
GLASS-TO-METAL SEAL POSITIVE HERMETIC SEAL

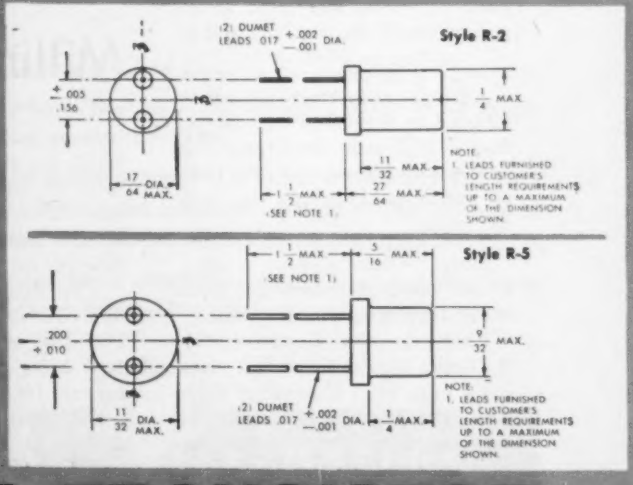
SPECIFICATIONS

	Style R-2	Style R-5
Resistance Range	0.1Ω to 750KΩ	0.1Ω to 750KΩ
Resistance Tolerance	±0.05% min. at 25°C	±0.05% min. at 25°C
Power Rating	⅛ watt continuous in free air (increased dissipation possible with heat sink)	⅛ watt continuous in free air (increased dissipation possible with heat sink)
Temperature Range	−65°C to +125°C	−65°C to +125°C
Maximum Operating Voltage	250V. DC	500V. DC
Temperature Coefficient of Resistance	±20 parts per million/°C	±20 parts per million/°C
Dielectric Strength	500V rms, winding to case	1000V rms, winding to case

Construction — Terminations: — Welded



ACTUAL SIZE


Style R-2
(2) DUMET LEADS .017 +.002 −.001 DIA.
.200 +.005 −.156
17/64 DIA. MAX.
1/2 MAX. (SEE NOTE 1)
11/32 MAX.
27/64 MAX.
1/4 MAX.
NOTE:
1. LEADS FURNISHED TO CUSTOMER'S LENGTH REQUIREMENTS UP TO A MAXIMUM OF THE DIMENSION SHOWN.
Style R-5
1/2 MAX. (SEE NOTE 1)
5/16 MAX.
.200 ± .010
9/32 MAX.
11/32 DIA. MAX.
(2) DUMET LEADS .017 +.002 −.001 DIA.
1/4 MAX.
NOTE:
1. LEADS FURNISHED TO CUSTOMER'S LENGTH REQUIREMENTS UP TO A MAXIMUM OF THE DIMENSION SHOWN.

*Pat. Pending

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CORPORATION

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FOR EXPORT: GENERAL TRANSISTOR INTERNATIONAL CORP., 91-27 138TH PLACE, JAMAICA 35, NEW YORK

Mica Tariff Cut

Import duties on two classes of strategic mica are eliminated, duty on better block is 4 cents

IMPORT DUTIES on three classes of mica are reduced or eliminated by a bill signed by President Eisenhower late last month. Adoption capped a four-year effort by mica fabricators and users to have tariffs on strategic mica cut back.

Most of the better grades of mica affected are used in electronic components. According to the Bureau of Mines, 1.7 million pounds of muscovite block and film mica was fabricated in the U. S. in the last six months of 1957. Of this, electronics consumed 63 percent. Half the total, or about 850,000 pounds, was stained qualities and electronics took 97 percent of this.

Tariff changes are:

- Unmanufactured block worth more than 15 cents a pound: the new duty is four cents a pound. Under the 1930 tariff act, duty was four cents a pound plus 25 percent ad valorem. Since the 1948 trade agreements, the duty has been two cents plus 15 percent.

- Mica films and splittings not cut or stamped to dimensions and not thicker than 0.0012 inch: duty free. This class was taxed at 25 percent under the 1930 act and at 12.5 percent in 1948-58.

- Films and splittings not cut or stamped to dimension and thicker than 0.0012 inch: duty free. The duty was 40 percent under the 1930 act and 20 percent under the 1948 agreement.

Duty remains at four cents a pound on unmanufactured block worth 15 cents a pound or less.

Efforts to have Congress relax the duties were initiated four years ago by the Mica Fabricators Association. A Mica Tariff Committee was formed two years ago by the association and some importers and users of the material. The House passed the bill last year and the Senate passed it on August 18, after hearing arguments that imports made up 90 percent of the U. S. supply of strategic mica.

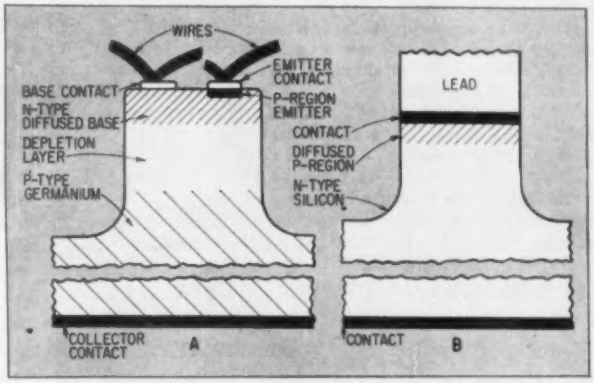
The bill will not adversely affect the domestic mica miners, according to S. A. Montague, Mica Tariff Committee chairman. The government pays premium prices for all domestically mined strategic mica. Duties are unchanged for the punch and scrap mica which represents 98 percent of commercial sales of domestic mica.

Solar Generator Works to 750 C

CADMIUM SULFIDE solar generator cells will continue to produce electricity to a temperature of 750 C, reports ARDC's Wright Air Development Center. Silicon solar cells temperature limit is given as 300 C.

WADC has had two cells made under research contracts with Harshaw Chemical and Eagle-Pitcher. Measuring 1/8 by 1.5 by 5.5 inches, they produce 150 milliwatts at 17 v when wired in series.

The wattage is twice that required by the Explorer satellite's two radios.



Mesa design of diffused base transistor (A) is applied to new diode (B) to produce . . .

Millimicrosecond Switch

DIFFUSED SILICON junction diode is being made in the mesa design which has contributed to development of higher frequency transistors. The new diode, for high-speed computers, has a switching time of one millimicrosecond.

The diode was described at WESCON by J. H. Forster and Paul Zuk, of Bell Telephone Labs. It is being produced by Western Electric for military applications.

Size of the active portion of the diode, and its capacitance, is kept small by ultrasonically cutting a mesa, or raised portion, in the silicon blank. The mesa is about 0.005 inch in diameter and 0.0025 inch high. The crystal remaining below the active portion acts as a "handle".

A slice of *n*-type silicon is boron-diffused to form the *p-n* junctions. The entire slice is plated to form contacts before the mesas are cut and the slice is divided into individual units. Recombination centers are provided by gold diffused in the crystal.

Depending on gold concentration, recovery time can vary from 0.5 to 20 millimicroseconds. Capacitance is 2.5 micromicrofarads, d-c reverse current is less than 0.015 microamp at 20 v and breakdown exceeds 40 v. Bakeout is

done at over 300 C, resulting in life expectancy of 100,000 hours.

A parallel method is used to produce *pnp* germanium diffused base transistors of 1,000 mc frequency. The technique is expected to yield transistors with frequencies up to 20 kmc.

To make the transistors, a slice of p-type germanium is diffused to produce an *n*-type layer. Contacts, emitters and p-regions for a number of transistors are prepared by vacuum evaporation and alloying. The slice is cut apart, individual units are mounted, masked with wax and etched to form the mesas, about 0.00012 inch high.

The technique is suited to mass production. It permits miniaturization, which contributes to higher-frequency operation. The monolithic design permits operation at higher temperatures and enables the transistor to withstand extreme physical shock.

Magnetic Value Redetermined

More accurate value for the gyromagnetic ratio of the proton has been measured by the National Bureau of Standards. The measurement, considered four times as accurate as one made in 1949, makes possible more precise values for constants dependent on magnetic field measurements.

In addition to basic research applications, the redetermination is expected to aid design and development of servomechanisms, electromagnets, mass spectrographs and cyclotrons.

Protons of hydrogen nuclei in distilled water were used as a sample, analyzed in a nonmagnetic building after the sample was magnetized. A preliminary value of $(2.67515 \pm 0.00001) \times 10^4$ radians/ (sec gauss), uncorrected for diamagnetism of the sample, was obtained in terms of the ampere now maintained at the Bureau. Under a more recent determination of the ampere, the numerical portion becomes 2.67513 $\pm$ 0.00002. The 1949 value had the figure 2.67523 $\pm$ 0.00006.

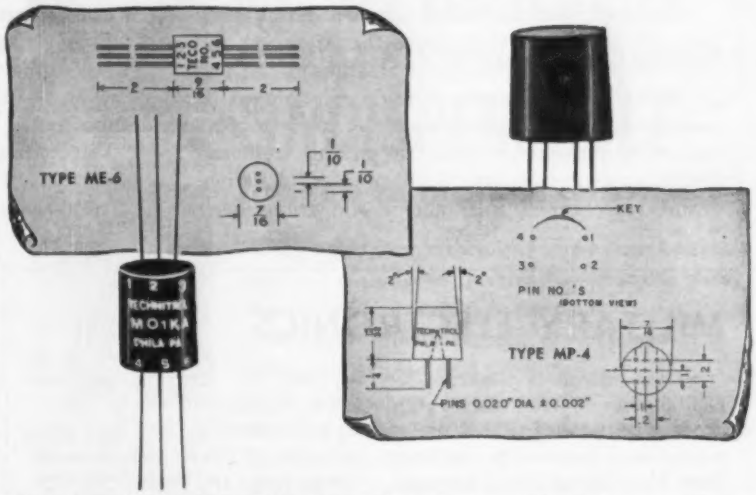
miniature

encapsulated

PULSE

TRANSFORMERS

by TECHNITROL



Wound on ferrite cores, the Type M series is available in a variety of windings to cover pulse widths from 2 microseconds down to .05 microsecond, wound inverting or non-inverting.

While the M series is particularly adapted to subminiature and transistor circuits, we design and build pulse transformers to fit specific circuits or to meet definite mechanical or thermal requirements, including MIL-T-27A.

Additionally, Technitrol makes a complete line of lumped and distributed parameter Delay Lines and a variety of electronic test equipment.

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Weather Probe Begins

New equipment buying seen as USAF launches aerial attack on problem of global weather forecasting

CONTINUOUS MEASUREMENT of the atmosphere is soon to be carried out by flying weather stations installed in Air Force 4-engine jet aircraft. The type plane used may be a KC-135. It must be capable of making 4,500-mi flights and operating at altitudes of 50,000 ft.

The weather reconnaissance system, designated AN/AMQ-15, includes two radar systems, instrument-packed rockets, atmospheric sensing equipment and electronic computers. Precise telemetry, navigation and communications gear are also required for the project.

At periodic intervals radiosondes will be launched from aircraft by rocket to probe the jet stream and other atmospheric phenomena at altitudes as high as 150,000 ft. Radiosondes will also be dropped by parachute to read weather data closer to earth. Factors to be measured include air pressure, temperature, dew point, icing rate, wind speed and direction, ozone, reflection of solar energy and atmospheric electricity. Data from the arctic regions and from over the oceans are expected to be particularly valuable.

Though intended primarily for USAF's Air Weather Station Service, data will also be supplied to commercial air lines, the Weather Bureau and to weather forecasting services serving industry and agriculture.

An $11-million contract with the Systems Division of Bendix covers the first 12 months of the estimated 36-month program for research, development and testing of a prototype weather system in principal associate Boeing's 707 jet airliner. In all, seven divisions of Bendix will assist in the project.

Air Force adds that eight or nine subcontractors will be selected at a later date. Universities and a number of suppliers will also be asked to participate in the program.

Engineering support is being supplied by the Aerial Reconnaissance Laboratory of USAF's Wright Air Development Center. Project engineer is D. R. Sink.

The contracting officer is E. W. Kirchmer and the buyer is R. E. Welsh, at Air Materiel Command, Dayton, Ohio.

MILITARY ELECTRONICS

• **Closed-circuit tv** allowed *USS Nautilus* crew to watch the ice pack above them during recent transpolar cruise. Installed by engineers from Mare Island Naval Shipyard and General Electric, the camera was mounted vertically in a pressurized one-ton steel capsule in the conning tower of the ship. GE is also working on sonar equipment for measuring ground speed to be used on submarines (ELECTRONICS, p 8, Aug. 29).

• **Propellant-loading system,** designed to shorten the countdown time of Convair's liquid-fuel Atlas ICBM, is announced by prime contractor A. D. Little and major subcontractor Minneapolis-Honeywell. System consists of a relay matrix-type sequencer which monitors the action of other system components and programs the succeeding steps in the loading sequence by verifying its own action. Other components: indicating and control devices; high pressure shut-off valves; and necessary storage tanks and piping. Though designed for Atlas, the system can be used with any liquid-fuel missile.

• **Seven C-47's** are being equipped as electronic laboratories by Collins Radio under a $1-million contract for Army Signal Corps. Purpose is to test airborne equipment for use in present and future Army planes. Equipment will include search radar, electronic automatic pilot and various radio navigation systems including TACAN.

• **Equipment to test** the operation of the B-58's "electronic shield" will be designed and developed by Farnsworth Electronics under subcontract with passive defense system contractor Sylvania.

CONTRACTS AWARDED

Northrop receives an $18,691,384 contract with AMC for R&D and flight testing the Snark.

Radioplane gets a $6,704,072 contract with Air Materiel Command for target drones for USAF, Army and Navy use. Also, a $2,066,749 contract with Army Signal Supply Agency for surveillance drones.

North American will conduct high performance flights with the X-10 drone to demonstrate weapon capability of the Bomarc. Contract with AMC amounts to $500,000.

Raytheon gets a $3,092,750 contract with Army Signal Supply Agency for development of a pulse code modulation system.

Philco will prepare an engineering design proposal for a radar recon-

naissance system for Army Signal Supply Agency under a $2,469,381 contract.

Textron is awarded a $500,000 prime contract from BuAer for design and development of a magnetic airborne detection system.

Ryan receives a $900,000 letter contract with Army Signal Supply Agency for production of RANAV, Model 120A, integrated automatic navigation and flight control system. Adaptable for both fixed-wing aircraft and helicopters, the system will use c-w Doppler.

Bendix is awarded a $1,750,000 contract with Boeing for development and production of the warhead proximity fuze for the new Bomarc IM-99B.

Waltham Precision Instrument receives an order from the Frankford Arsenal for elapsed timers for aircraft, amounting to $535,000.

American Machine and Foundry wins a $1,629,911 contract with AMC for AN/GPS-T4 radar target simulator trainers, spare parts, engineering and maintenance data.

American Bosch Arma receives a $3,240,000 contract with AMC for the B-52's tail defense fire control system.

GE will furnish AN/APS-81 search radar sets for the B-52 under a $5 million contract with AMC.

RCA receives a $1.5 million contract with Philadelphia Ordnance District for multipurpose missile system test equipment.

Lear gets a $3.4 million contract with AMC for automatic flight control systems, MC-1, used in the KC-135A.

Burton Manufacturing gets more than $\frac{1}{2}$ million in orders from North American for Burton Mach Sensing Systems. Used in high performance jet aircraft, the system senses altitude and airspeed, computes Mach number and provides electrical signals for control.

Welding .008" diameter wire to a part the size of a fly's wing —3-D micro-vision makes precision possible.

Part to be welded shows up sharply under 13X magnification.

45X magnification and measuring reticle let inspector check winding tap-off gap to .5° (.001"). Potentiometer shown below, actual size . . . tap-off leads at top.

Why ACE ELECTRONICS calls B&L Stereomicroscopes "*INDISPENSABLE* for sub-miniature assembly"

Mounting a triangle this size to a shaft head this size with screws this size is just one phase of sub-miniature potentiometer production in the Somerville, Mass., plant of Ace Electronics Associates, Inc. Finished product is only ½" in diameter, ½" long, yet conforms to electrical characteristics of units four times its size. Precision specifications hold work to tolerances of .001". That's why Ace uses over 100 B&L Stereomicroscopes—for magnified, distortion-free views in natural 3-D aspect—in every stage of manufacture from assembly to measurement to inspection.

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- ☐ Send me B&L 3-D Micro-Vision Book (Cat. D-15).

NAME.....

TITLE.....

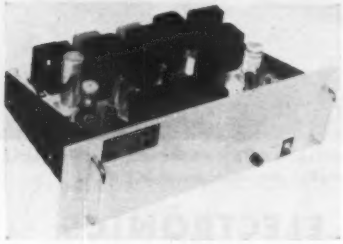
COMPANY.....

ADDRESS.....

NEW PRODUCTS

H-V Capacitors double-cup

SPRAGUE ELECTRIC CO., 35 Marshall St., North Adams, Mass. Types 90C and 91C double-cup h-v ceramic capacitors may be used in transmitters, electronic welding equipment, induction heaters, x-ray, diathermy and other h-f circuits. Rugged mechanical construction and long leakage paths are a feature of the double-cup design. The special ceramic dielectric used has an extremely high Q and very stable retrace characteristics. A typical capacitor rated at 75$\mu\mu$f at 5 kv can carry a current of 14.5 amperes at 30 mc. **Circle 50 on Reader Service Card.**



Ratio Computer 1 percent accurate

MAGNETIC INSTRUMENTS CO., 546 Commerce St., Thornwood, N. Y. Model 05572-2 precision ratio computer accepts two independent d-c signals as low as 1 mv full-scale per channel and computes their ratio to an accuracy of 1 percent. Employing chopper and a-c circuitry throughout, the unit has virtually no drift. Typical applications include the measurement of ratios from strain gage type transducers, thermocouples, resistance bulbs and other low level voltage devices. **Circle 51 on Reader Service Card.**

Building Blocks for digital systems

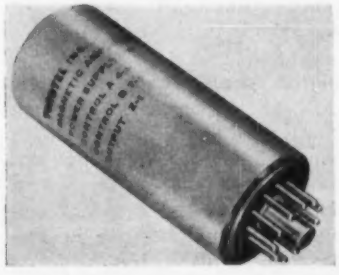
HARVEY-WELLS ELECTRONICS, INC., 5168 Washington St., West Roxbury, Mass., announces high speed (5 mc) transistor building blocks for digital systems. Useful to logic designers and engineers alike, Data Blocs may be easily combined by a pluggable pin-jack system to rapidly produce special test equipment and complete digital systems. The basic blocks can be reused any number of times to form other special laboratory gear as needed. It is possible to rapidly assemble shift registers, counters, pulse generators, pattern generators and experimental prototypes in a matter of minutes rather than days by the use of this system. **Circle 52 on Reader Service Card.**

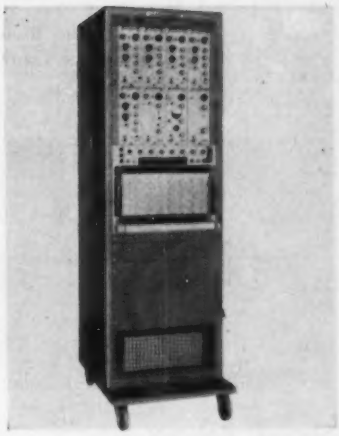
Peak Meter with new probe

CONTROL DEVICES, INC., 8299 E. Nine Mile Road, Warren, Mich. A new frequency-compensated probe extends the range of the model PTM-7 peak-meter from 300 v up to 3,000 v. Function of the peak-meter is to register voltage pulses which are much too fast to measure on conventional voltmeters. It responds instantaneously to the peak value of the waveform regardless of shape and holds the reading until a reset button is pressed. **Circle 53 on Reader Service Card.**

Magnetic Amplifier for missile systems

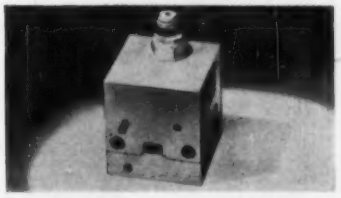
TOROTEL, INC., 5512 E. 110th St., Kansas City 34, Mo., has announced a new line of magnetic amplifiers called the "O" series. Input is bi-directional, d-c, for both control windings; output bi-directional 7.5 v d-c. Gain for each control winding is 2.5 v for a 100 μa input. Gain stability is $\pm$10 percent. The output with zero input shall not exceed 75 mv d-c. The amplifier operates from a 115 v 400 cycle $\pm$10 percent source. Standard case size is 1½ in. o-d and 3 in. high with an 11-pin plug having a locating key. Typical applications include missile and aircraft guidance systems. **Circle 54 on Reader Service Card.**





Recording System
6- or 8-channel

SANBORN CO., 175 Wyman St., Waltham 54, Mass. The "350" series of 6- and 8-channel direct-writing oscillographic recording systems are packaged in a single mobile vertical cabinet. Performance specifications include frequency response flat to 100 cps at 10-division peak-to-peak amplitude and 3 db down at 120 cps; linearity 0.2 div over the entire 50 divisions; hysteresis level less than 0.2 div. **Circle 55 on Reader Service Card.**



Microwave Diode
for 50-75 kmc

MICROWAVE ASSOCIATES, INC., Burlington, Mass. Type MA-428 microwave silicon diode exhibits high tangential sensitivity over the 50 to 75 kmc range. System noise figures between 15 to 18 db can be achieved using a matched pair of these diodes as mixers in a rat race power divider (MA-606) balanced mixer assembly in conjunction with a low noise i-f strip. The MA-428 may be used also as a high sensitivity detector in low level video receiver applications. The diode requires no mount and is

TV tube manufacturers depend on Stokes aluminizers

Stokes twin-tube aluminizers are fully automatic . . . offer high production rates for black and white screens or color plate processing . . . service any type tube, including the 110° bulb and special C.R.T.'s.

•

These are some of the users of Stokes aluminizing equipment. Call on the Stokes Advisory Service for application information, or write for data and specifications sheet.

American Standard TV Tube
Jamaica 33, N. Y.

Arcadia Development Company, Inc.
St. Louis, Mo.

B & L Electronics Industries Limited
Montreal, Quebec, Canada

Budco, Incorporated
Louisville 8, Ky.

Claremont Tube Corporation
Long Island City, N. Y.

Continental Electronics
Philadelphia, Pa.

Durabeam Electronics Company
Independence, Mo.

Electronic Tube Corporation
Philadelphia 18, Pa.

National Video Corporation
Chicago 32, Ill.

Pan-American Electronics Inc.
Miami, Fla.

Pioneer Electronics Corporation
West Los Angeles 64, Calif.

Progressive Electronics Company
Yonkers, N. Y.

Radio Corporation of America
Lancaster, Pa. and Marion, Ind.

Sylvania Electric Products Co., Inc.
Seneca Falls, N. Y.

Theta Electronics, Inc.
Greensburg, Pa.

Thomas Electronics, Inc.
Passaic, N. J.

Tung Sol Electric Co.
East Orange, N. J.

Vacuum Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

American Blower suggests:

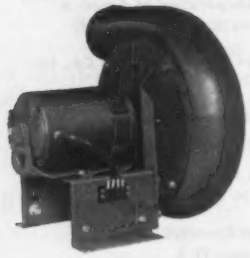
PACKAGED CURE FOR HEAT-CAUSED "BUGS"

Countless "bugs" in delicate electronic equipment result from deterioration of components from their own heat. Cure: Dependable cooling, provided by an American Blower packaged air-moving unit. Numerous sizes and designs to choose from—many can be modified as needed. Or, if necessary, we can start from scratch and design a fan or blower to fit your exact needs. For individual specification bulletins, write, detailing your requirements. American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ont.

FOR COOLING ELECTRONIC EQUIPMENT IN AIRCRAFT

Small aluminum axial-flow fan. Capacity: 110 cfm @ 0.6" sp to 165 cfm, free delivery @ 7250 rpm. Write for Bulletin 3812.

FOR RADAR COOLING



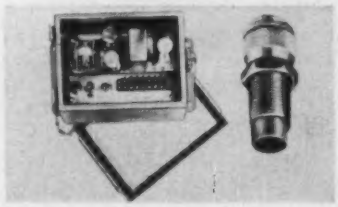
Aluminum pressure blower. Capacity: 984 cfm @ 1" sp to 536 cfm @ 7" sp @ 3450 rpm. Write for Bulletin 4512.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
AMERICAN BLOWER DIVISION

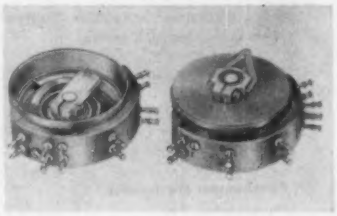
CIRCLE 17 READERS SERVICE CARD

bolted directly to RG-98U waveguide flanges. I-F or video output coupling is obtained by means of a miniature Microdot output connector located on the top face of the diode. **Circle 56 on Reader Service Card.**



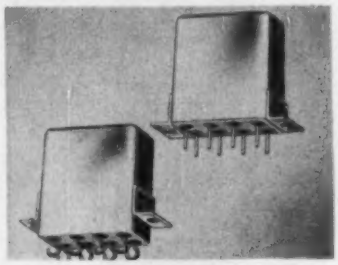
Transducer System proximity type

ELECTRO PRODUCTS LABORATORIES, 4500 N. Ravenswood Ave., Chicago 40, Ill., announces a proximity transducer system consisting of a pickup, mounted at the point of work; a shielded connecting cable; and a control unit. The presence of metallic workpieces in close proximity to the pickup causes the connected control unit to provide an electrical pulse that governs associated mechanical or electronic production operations. A wide variety of manufacturing operations is being automated through its use. **Circle 57 on Reader Service Card.**



Precision Pot highly versatile

GEORGE RATTRAY & CO., 116-08 Myrtle Ave., Richmond Hill 18, N. Y. Model 200-CEUS two-in. precision pot finds wide acceptance in the simulator field. It is modular designed as each individual cup is self-contained. Thus, great flexibility of stacking is achieved. The pot can be supplied with as many as 13 pre-set taps or it can be tapped in the field by the user. **Circle 58 on Reader Service Card.**



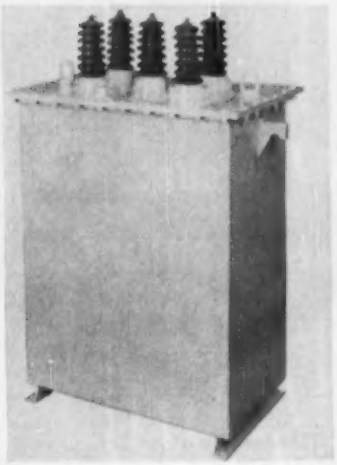
Sealed Relays subminiaturized

STRUTHERS-DUNN, INC., Pitman, N. J. The FC-2 dpdt subminiature hermetically-sealed relays withstand 30 g vibration at 2,000 cycles; 50 g Class II shock; −65 to 125 C ambients; and are designed for power and low level switching. They are available with hook terminals or short or long wire leads. Terminals have 0.2 in. grid spacing. Contacts are rated 2 amperes resistive at 26.5 v d-c and 115 v a-c. **Circle 59 on Reader Service Card.**

Power Supply ultrahigh regulation

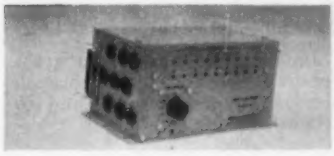
KROHN-HITE CORP., 580 Massachusetts Ave., Cambridge, Mass. The model UHR-216 power supply provides ultrahigh regulation from 160 to 600 v for loads from 0 to 100 ma. It has 0.002 percent regulation and 100 μv ripple over the

entire operating range. Internal impedance is less than 0.1 ohm for frequencies as high as 100 kc. Transient response is 0.001 millisec. Typical 10-hr drift is 500 ppm. **Circle 60 on Reader Service Card.**



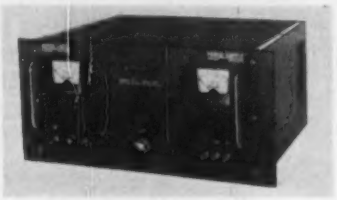
Transformers and reactors

Electro Engineering Works, Inc., 401 Preda St., San Leandro, Calif. Matched modulation transformers and reactors for a-m broadcast transmitter applications are announced. Available in units for 250 w, 500 w, 1 kw, 10 kw and 50 kw transmitters, the new design permits size and weight reductions with highest reliability in performance. Response within 1 db from 50 to 10,000 cps with under 2.5 percent distortion is obtained without feedback. **Circle 61 on Reader Service Card.**



Bridge Balance 18 input plugs

Datran Electronics, 1836 Rosecrans Ave., Manhattan Beach, Calif. A new miniature strain gage bridge balance box provides means for interconnecting a power supply and 18 strain gage bridges to a multichannel recording instrument. In addition, means are included for balancing the bridges, establishing the desired sensitivity and for automatic remote calibration of each channel. The instrument measures 7¼ in. by 4 in. by 3½ in. and weighs less than 2¼ lb. **Circle 63 on Reader Service Card.**



Tubeless Supply voltage regulated

Kepco Laboratories, Inc., 131-38 Sanford Ave., Flushing 55, N. Y. Model SC-32-10 tubeless transistorized voltage regulated power supply delivers 0-32 v, 0-10 amperes. Regulation for line or load is less than 0.01 percent or 0.002 v, whichever is greater. Ripple is less than 1 mv rms. Recovery time is less than 50 μsec. Stability for eight hours is less than 0.01 percent or 0.002 v, whichever is greater. Operating ambient temperature is 50 C maximum. Temperature coefficient is less than 0.01 percent per deg C. Output impedance is less than 0.001 ohm. **Circle 62 on Reader Service Card.**

Vibrating Capacitor converts d-c to a-c

Stevens-Arnold, Inc., 22 Elkins St., South Boston, Mass., announces a vibrating reed type capacitance modulator used to con-

ACCEPTED SYMBOLS

Carbon! Element of contrasts! Source of deadly poisons and life-saving drugs . . . black coal and m'lady's glittering diamonds. To Tung-Sol, carbon, best known heat radiator, means improved electron tubes.

During operation, tubes heat up. If heat becomes excessive, it threatens tube operating efficiency and can cause tube failure.

Where this problem is critical, Tung-Sol makes the sensitive parts of carbon. Heat flows harmlessly out and away from the carbon units, thereby extending efficient tube life.

Use of carbon exemplifies Tung-Sol's adherence to the highest standards of materials and workmanship. This policy guides all Tung-Sol activities . . . has been maintained without compromise through years of product diversity. It explains why, today, Tung-Sol is widely recognized as symbol of finest quality.

Tung-Sol Electric Inc., Newark 4, N. J.

TUNG-SOL

QUALITY ELECTRONIC AND AUTOMOTIVE COMPONENTS

CIRCLE 18 READERS SERVICE CARD

Malco IS YOUR BEST SOURCE
FOR
SOLDERING LUGS
TERMINALS
PRINTED CIRCUIT
HARDWARE

HERE'S WHY:

- Specialized high production techniques afford lowest possible unit cost.
- Precision tooling, rigid quality control assure tolerances to critical specifications.
- Ample stocks of over 1000 different parts permit prompt delivery.
- Malco specializes in a complete line of small stampings for Radio-TV, electrical/electronic and automotive industries.
- Our line includes terminals and printed circuit hardware in loose or in chain form for automatic insertion.

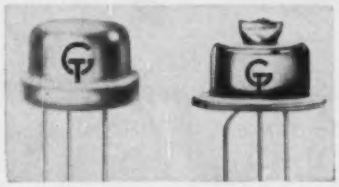
Let Malco show you how you can save on production time and costs. Contact us today.

Request handy reference catalog containing specifications on standard and custom-made lugs, terminals, corona rings, pins, contacts and similar stampings.

Malco TOOL and MANUFACTURING CO.
4023 W. Lake St., Chicago 24, Ill.

CIRCLE 19 READERS SERVICE CARD

vert d-c into sinusoidal a-c for easy amplification. The VC-713 is capable of measuring currents as low as 10^{-16} amperes from a very high impedance source. Popular uses will include mass spectrometry and circuits for measuring (1) insulation resistance and dielectric leakage currents, (2) pH, (3) radioactivity, and (4) output of ionization chambers. An outstanding feature is its virtual freedom from drift. **Circle 64 on Reader Service Card.**



Transistors general purpose

GENERAL TRANSISTOR CORP., 91-27 138th Place, Jamaica 35, N. Y., has available 10 new general purpose transistors, types 2N563 through 2N572. Five of the germanium alloyed junction units are packaged in the Jetec 30 welded case, and five in the military case. They are recommended for applications where tight parameter control and high reliability are desired. **Circle 65 on Reader Service Card.**

Phase Meter and phase shifter

DYTRONICS, P.O. Box 3676, Beechwold Station, Columbus 14, Ohio. Model 301 phase meter and phase shifter provides operation over the 10 cps to 30 kc range. Phase angle

Tax trend reversed in Duval County
JACKSONVILLE
FLORIDA

'58 tax rate down 3.2 mills

Long friendly to industry, business and individuals, the tax climate in Jacksonville and Duval County has been improved by a 3.2 mill cut for 1958 under '57. This was accomplished by the addition of $24,000,000 to tax rolls through industrial and business development, and yet no increase in the level of assessments.

Yet there have been no cuts in the constantly expanding school program, hospitals or other essential public services. It exemplifies a continuing awareness of the need for a favorable tax structure and our effort to make Jacksonville a better place to work and live.

Jacksonville also enjoys the general benefits of Florida's excellent tax climate... no state income tax, no state ad valorem tax, no direct state inheritance tax.

Jacksonville offers you great opportunities for a plant, branch plant, office or warehouse and for delightful living.

Write today for THE JACKSONVILLE TAX FOLDER.

IDEAL EVERY DAY FOR WORK AND PLAY
THE CITY OF JACKSONVILLE, FLORIDA
Electric and Water Utilities
THE COMMITTEE OF ONE HUNDRED
Jacksonville Area Chamber of Commerce
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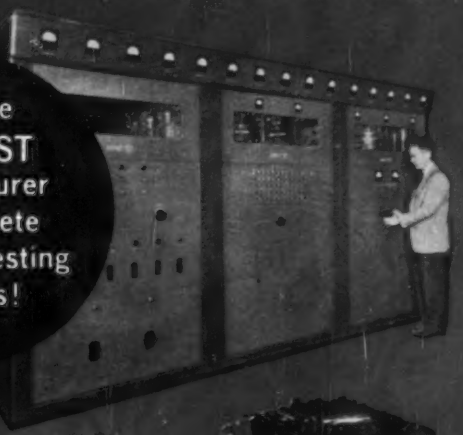
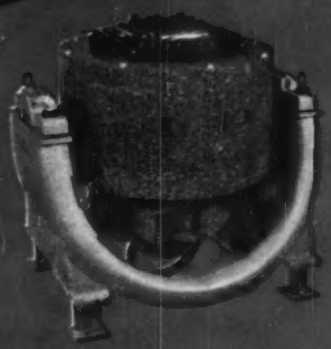
CIRCLE 20 READERS SERVICE CARD
CIRCLE 21 READERS SERVICE CARD→

two leaders in vibration testing combine

now the LARGEST manufacturer of complete vibration testing systems!



LING CALIDYNE



Here's how this integration benefits YOU

- You benefit from new integrated *engineering* programs that bring you great new advances in vibration testing systems and techniques.
- You benefit from new integrated *manufacturing* programs that shorten deadlines... speed deliveries.
- You benefit from new integrated *sales and service* teams that assure top efficiency in the field from coast to coast.
- You benefit from new integrated *management* and *administration* that offers a complete line of vibration testing systems in all sizes and ratings... with all components matched for optimum system performance.

LING ELECTRONICS, INC.
... leader in the manufacture of high-power, electronic vibration amplifiers and vibration control systems.

THE CALIDYNE CO., INC.
... leader in the manufacture of electrodynamic shakers and vibration control systems for every range of vibration test programming.

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ELECTRONICS INC.

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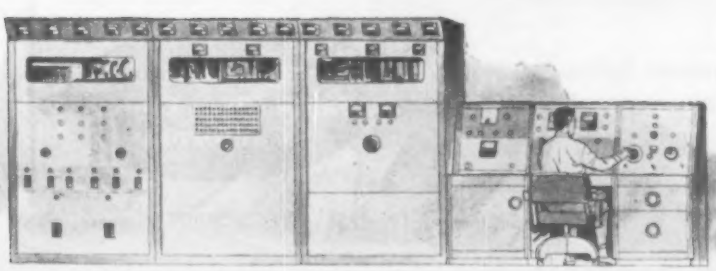
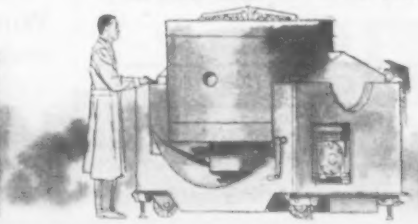
9937 W. Jefferson Blvd.
Culver City, California

THE CALIDYNE COMPANY, INC.
120 Cross Street
Winchester, Massachusetts





Reaching for a better way to read and record industrial data?

BEATTIE MODEL D VARITRON cameras, electrically pulsed, are used to record photographically on still pictures the data required by business, science and industry. The versatile Model D Varitron is a fixed position instrumentation camera that may be mounted conventionally or on its face plate. A compact data recording chamber completes the camera's efficiency giving time, numbers or written identification to every exposure.

for more information write to

BEATTIE–COLEMAN *inc.*

1000 N. Olive St., Anaheim, California

CIRCLE 22 READERS SERVICE CARD

is read directly in degrees on a large circular dial. The phase meter offers high sensitivity and input impedances for both input and reference signals. The phase shifter provides a 300 ohm output impedance and a signal level adjustable from 0 to 5 v rms. **Circle 66 on Reader Service Card.**

V-T Voltmeter
random access

MEASUREMENTS, a McGraw-Edison Division, Boonton, N. J. Model 162 vtvm with push button switches is announced. This arrangement provides random access to all functions and ranges, making it unnecessary to switch through several adjacent functions or range positions as required with rotary switches. Push button switching reduces operator error and fatigue, and permits rapid switching to a higher voltage range when overload is imminent. **Circle 67 on Reader Service Card.**

Window Splice
moisture proof

AMP INC., Harrisburg, Pa., has released a new moisture proof win-

We got our start in Santa Clara County* California

...and we're glad to be here!*

Mr. J. E. Jennings, President of Jennings Radio, explains the desirability of their Santa Clara County location this way:

"In our case, it was primarily the availability of good land for low cost single story construction that made this area so desirable. Of course, we are pleased with our location in Santa Clara County for other reasons, too. These include the variety of excellent service industries nearby and the highly skilled technical help which is so necessary in the manufacture of vacuum electronic components."

Statements from men like this are very significant. Talk with the people at Jennings. Then forecast your future in this liveable community at the southern tip of San Francisco Bay.

WRITE FOR FREE REFERENCE DATA
Take a minute now to send for the informative booklet, "What Does Santa Clara County, California offer the ELECTRONICS INDUSTRY?"

Greater San Jose Chamber of Commerce
Dept. 7, San Jose, California

SAN JOSE
Santa Clara County
California

dow connector—AMP Certi-Seal splice that eliminates entry of moisture due to breathing caused by altitude changes in aircraft circuitry. The new splice is designed with tin-plated copper rings at both ends which crimp over the wire insulation for a permanent seal against vapors and fluids. Intended primarily for use in aircraft or missile circuitry, the new connector will fit more than 100 insulation diameters in military specifications up to No. 10 Awg. **Circle 68 on Reader Service Card.**

Phono Jack
simple mounting

Richards Electrocraft, Inc., 4432 N. Kedzie Ave., Chicago, Ill. Phono Jack No. 8575 may be mounted with a single nut and washer. Its easy method of mounting greatly simplifies both basic assemblies and replacement operations, and eliminates the critical alignment necessary for drilling three holes and mounting with screws, nuts and washers. **Circle 69 on Reader Service Card.**

Audio Oscillators
switch controlled

Dunlap Electronics Inc., 764 Ninth St., Des Moines, Iowa. The PO-2 and CO-2 audio oscillators are designed to furnish audio signals for general testing and measurement in radio, tv broadcasting, telephone, and sound system applications. The units furnish audio signals of 1 kc and 400 cps at output levels of 0 db and −60 db at an output impedance of 600 ohms. **Circle 70 on Reader Service Card.**

MINIATURE AND SUB-MINIATURE

relays by **Hi-G**

Rugged and reliable relays are manufactured at Hi-G in a wide range of standard units... and to customer order with special designs to meet your particular requirements.

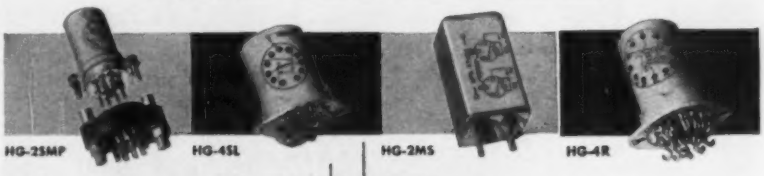
Complete experimental and prototype facilities permit Hi-G engineering personnel to study and evaluate your relay needs.

New, complete illustrated specification sheet available. Write for your free copy today.

And for information on special relay units, send your specifications to Hi-G for study and recommendations at no obligation.

rugged / reliable / shock and vibration resistant

A FEW OF THE WIDE RANGE OF HI-G STANDARD RELAYS



Hi-G inc.

BRADLEY FIELD WINDSOR LOCKS, CONN.

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PRECISION WAVEGUIDE BENDING

TO YOUR SPECIFICATIONS

Bends, Twists, Offsets, Coils, Transitions, Fabrications and complete assemblies to your prints.

Specialty

AUTOMATIC MACHINE CORPORATION

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CIRCLE 25 READERS SERVICE CARD

Management Executives—

SEND FOR NEW COMPLETE ECONOMIC STUDY OF METROPOLITAN MIAMI

LET US SHOW YOU HOW YOUR COMPANY CAN PROFIT BY LOCATING IN THIS FAST GROWING AREA.

A 24 section, complete economic analysis has just been prepared to supply you with complete data which will assist in determining how your particular manufacturing or statewide, national/international distribution operation can profit here. This important study will be mailed to you free of charge—in strictest confidence—if you write, on your letterhead, to the address listed below.

Please . . . no employment applications. We are deluged with resumés from engineers, tool makers, technicians, Ph.D.'s, etc., and cannot possibly aid in placement requests as we already have a tremendous surplus of skilled and professional labor here now. Sorry.

WRITE **John N. Gibson, Director**
DADE COUNTY
DEVELOPMENT DEPARTMENT
Section: 35
Chamber of Commerce Bldg. • Miami, Florida

An agency of the Metropolitan Miami government

CIRCLE 26 READERS SERVICE CARD

NEW
SEMICONDUCTOR DEVICE

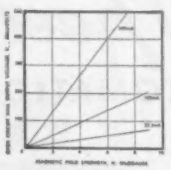
Halltron
TYPE HS-51

The HS-51 HALLTRON is based upon the Hall effect. Its output characteristics are related to the product of the input current and magnetic field, hence are useful in many new applications. The HS-51 HALLTRON is a fully developed production unit utilizing indium antimonide and is designed to work in the customer's magnetic circuit.

Applications of the HS-51 HALLTRON
- DC to AC converters
- Magnetic field measurement
- Computer applications
- Control applications
- Gyrators
- Circulators
- Power meters
- Transducers

Typical Room Temperature Characteristics

Typical open-circuit Hall output voltage of an HS-51 HALLTRON vs. magnetic field strength for various values of control current, Ic.



OHIO SEMICONDUCTORS, INC.
1015 W. THIRD AVENUE, COLUMBUS 8, OHIO

CIRCLE 27 READERS SERVICE CARD

Here's how you can
MERCHANDISE YOUR ADVERTISING
with these handy 9" by 12" folders

Keep your sales, management and distribution people informed on your advertising. Circulate preprints, reprints, schedules and other material in these folders, and make your advertising dollars work *over and over* for you.

Write for illustrated folder and price list

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McGraw-Hill Publishing Co., Inc.
330 West 42nd Street, New York 36, N. Y.

Literature of

MATERIALS

Stripping Agent. Isochem Resins Corp., 221 Oak St., Providence 9, R. I. Data bulletin DB-701-81 describes Isostrip 701, a fast acting stripping solvent for recovering valuable parts coated, cast or molded in epoxy or polyester compounds. **Circle 71 on Reader Service Card.**

COMPONENTS

C-R Tubes. Waterman Products Co., Inc., 2445 Emerald St., Philadelphia 25, Pa. Engineering data on Rayonic cathode-ray tubes including applications, characteristics, and general information are available. **Circle 72 on Reader Service Card.**

Electrical Connectors. Cannon Electric Co., 3208 Humboldt St., Los Angeles 31, Calif., announces a bulletin describing the type EX Cannon plug, a fully environmental-resistant line of electrical connectors designed primarily for use in aircraft and missiles. **Circle 73 on Reader Service Card.**

Low Frequency Crystal. Bliley Electric Co., Union Station Bldg., Erie, Pa. Bulletin 511 contains technical data on a new crystal for missile application. Frequency range of the crystal described is from 4 kc to 600 kc, with reliable performance at temperatures up to 185 C. **Circle 74 on Reader Service Card.**

Magnetic Amplifier. Acromag, Inc., 22519 Telegraph Road, Detroit 41, Mich., has a new two-color, two-page bulletin describing the 430 integrating magnetic amplifier. The amplifier described is used in missile guidance systems, industrial controls and other precision control equipment. **Circle 75 on Reader Service Card.**

Wire-Wound Resistors. Ultronix, Inc., 116 S. Bayshore Blvd.,

the Week

San Mateo, Calif. A four-page bulletin describes the new line of fully encapsulated precision wire-wound resistors which feature unusual stability, extremely low temperature coefficient, and close tolerance. **Circle 76 on Reader Service Card.**

EQUIPMENT

Data Processing System. Beckman Systems Division, 325 N. Muller Ave., Anaheim, Calif. Bulletin 3014 provides detailed information on features, applications and specifications of the model 123 data processing system. **Circle 77 on Reader Service Card.**

Nuclear Instrumentation. Borg-Warner Corp., 3300 Newport Blvd., Santa Ana, Calif. Detectolab model DM12 linear count rate meter, model DA5 linear amplifier and model DS8 precision binary scaler are described in new technical bulletins. **Circle 78 on Reader Service Card.**

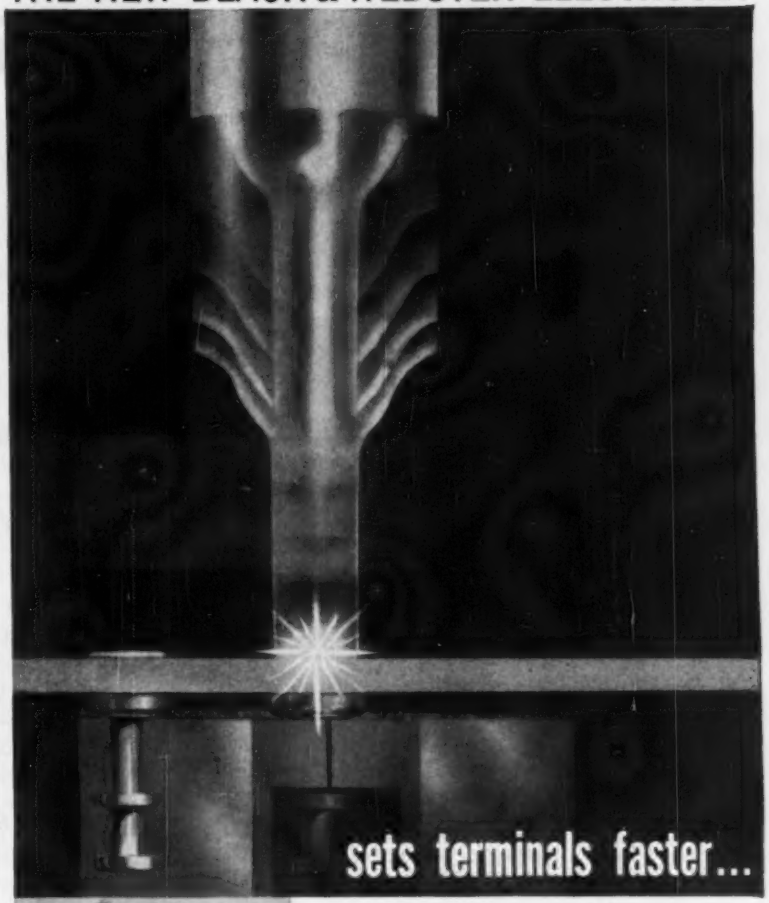
Transistorized Power Supplies. Lambda Electronics Corp., 11-11 131 St., College Point 56, N. Y. A 4-page folder contains outline dimensions, special features and specifications for its model L-T convection cooled, transistorized power supplies. **Circle 79 on Reader Service Card.**

Vidicon Camera. Radio Corp. of America, Camden, N. J. Use of the TK-15 vidicon television camera as the nucleus of an economical and versatile tv system is described in a new brochure. **Circle 80 on Reader Service Card.**

FACILITIES

Product Design. Designers for Industry, 4241 Fulton Parkway, Cleveland 9, Ohio. In a recent 20-page brochure 24 examples of "planned product" development technique are illustrated, with the problem, solution and new design concepts used detailed in each case. **Circle 81 on Reader Service Card.**

THE NEW BLACK & WEBSTER **ELECTROSET**



with fewer rejects...

than any production tool you have ever used

The new Black & Webster ELECTROSET is an all electric solenoid-operated high production tool for setting standard turret type or seamed terminals. It speeds up production, reduces costs because it is automatic, accurate — and lightning fast. Here's how:

OPERATION—Terminals are fed to staking nest automatically from 8" vibrator feeder. Operator simply places board over terminal and triggers Electropunch, staking terminal in the board. As operator withdraws board, feed automatically advances new terminal to nest.

FASTER PRODUCTION—limited only by operator speed in feeding board. ELECTROSET has achieved rates to 3600 per hour.

CONTROLLED IMPACT—careful control through variable voltage transformer, capable of varying impact from feather touch to 3500 lbs. Accurate, positive "punch" eliminates rejects from too-light or too-heavy blows.

EASY POSITIONING—light beam under punch head indicates exact terminal location, when terminal is hidden by board.

VERSATILE—adaptable to feeding and setting contacts, pins, shoulder studs and plug nuts.

SEND SAMPLE TERMINAL FOR EVALUATION.

BLACK & WEBSTER, INC.

DEPT. E, 445 WATERTOWN STREET, NEWTON 58, MASSACHUSETTS

CIRCLE 29 READERS SERVICE CARD

Japanese Push Radioisotopes

Experts see new applications, increased instrument output as studies continue

JAPANESE SPECIALISTS report industrial interest in radioisotope-equipped instruments is opening new applications and new markets in their country.

During a recent visit to the U. S., a 12-man team of Japanese experts was interviewed by ELECTRONICS. Here is the picture they presented of radioisotope use, production and research in Japan:

Industrial uses of radioisotopes and associated test equipment are just now becoming practical. Radiography is used widely, such as in examination of castings and welds at shipyards and machine works.

Value of Japanese-produced radiation measuring instruments, parts for radiation measuring instruments and other apparatus equipped with radioisotopes is now about $2.47 million a year.

This production is expected to increase rapidly with advances in radioisotope use in the atomic energy industry. An estimated 70 percent of such instruments now being used in Japan are American.

Thickness, density and liquid-level gages equipped with isotopes are being used to a limited extent in manufacturing as development continues.

Control systems using radioisotope-equipped gages are also under study. But right now many studies are directed towards quality control. The experts add that more development is also necessary in such associated devices as d-c, pulse and converter amplifiers and vibrating-reed electrometers.

Measuring devices using radioisotopes are primarily used as indicating meters in Japan. But studies of control through gaging are progressing steadily.

Japanese scientists believe the ionization chamber holds promise for industrial use. They cite its simple circuits, relatively trouble-free operation, high speed of response and short resolving time, and accuracy of measurement. Application studies include: use of the parallel-plate-type ionization chamber for monitoring alpha contamination of clothing and floors; measurement of background radiation with a spherical ionization chamber; and measurement of argon 41.

Work on scintillation counters is said to be "comparatively new." Researchers are interested in their use for fast neutrons, gamma rays and slow neutrons.

Multiplier phototubes with performance characteristics similar to U. S. tubes have reportedly been made. In addition, tubes with chamber-type electrodes are being studied. Scalers, rate meters, pulse-height analyzers, linear amplifiers, distributed amplifiers, delay circuits and coincidence-anticoincidence circuits for scintillation counters are under study.

A single-channel gamma-ray spectrometer has reached the production line. Studies to improve the accuracy of multichannel spectrometers and to reduce their size are going on.

DEVELOPMENTS ABROAD

• **Russian** electronic engineers claim to have cut the time of metal fatigue testing from "several weeks" to one hour. A Soviet publication says electronic testing and control equipment designed by engineers in the Ukraine determines the precise fatigue limit of iron, steel, nonferrous metals and their alloys, and metal ceramic at normal and high temperatures. The test set is equipped with a magnetic vibrator which transmits alternating loads at the rate of 20,000 times a second to the metal under test. Special steel and alloys can be fatigue-tested at a load alternating at 300-million times a second. Operation is said to take 30 hours compared to two years by older methods.

• **Britain's** new five-year, $15-million plan to modernize her air traffic control system envisages new long-range radar stations at four strategic points—southeast England, Manchester, the west country, and near Prestwick, Scotland. At these stations, electronic equipment will receive, store and display information required by controllers. Plan features a reduction in the amount of communication between aircraft and ground. This results in an extension of radar coverage; four new radar stations will have a low-level range of 85 miles and a high-level range of more than 100 miles. Data will go automatically to three civil-military centers in London, central England, and Scotland.

EXPORTS and IMPORTS

Indonesia is placing a $10-million order for tv and other communications equipment with West German companies, according to German press reports. The foreign exchange bureau is said to have received instructions from the government to make available the necessary foreign currency.

Norway's Ministry of Defense has just ordered $3 million worth of Marconi radar equipment as part of the NATO infrastructure program. Details are classified, but it is known that the order includes two high-power, long-range control and reporting stations.

Poland reports production of 18,-

Only Merck makes all three forms of ultra-pure

SILICON

for semiconductor applications

Merck Polycrystalline Billets—have not been previously melted in quartz, so that no contamination from this source is possible. Merck guarantees that single crystals drawn from these billets will yield minimum resistivities over 50 ohm cm. for n type material, and over 100 ohm cm. for p type material. Merck Silicon Billets give clean melts with no dross.

Merck Polycrystalline Rods—are ready for zone melting as received . . . are ideal for users with floating-zone melting equipment. Merck Polycrystalline Rods (8½ to 10½ inches long and 18 to 20 mm. diameter—smaller diameters on special order) yield more usable material. In float-zone refining one can obtain minimum resistivities of 1000 ohm cm. p type with minimum lifetime of 200 microseconds.

Merck Single Crystal Silicon—offers manufacturers without floating-zone equipment semiconductor Silicon of a quality unobtainable elsewhere. No crucible-drawn crystals can match the reliability of Merck single crystal material in semiconductor devices. Merck Single Crystal Silicon is available with min. resistivity of 1000 ohm cm. p type. Other resistivities ranging from 1.0 ohm cm. p or n type up to 1000 ohm cm. will soon be available.

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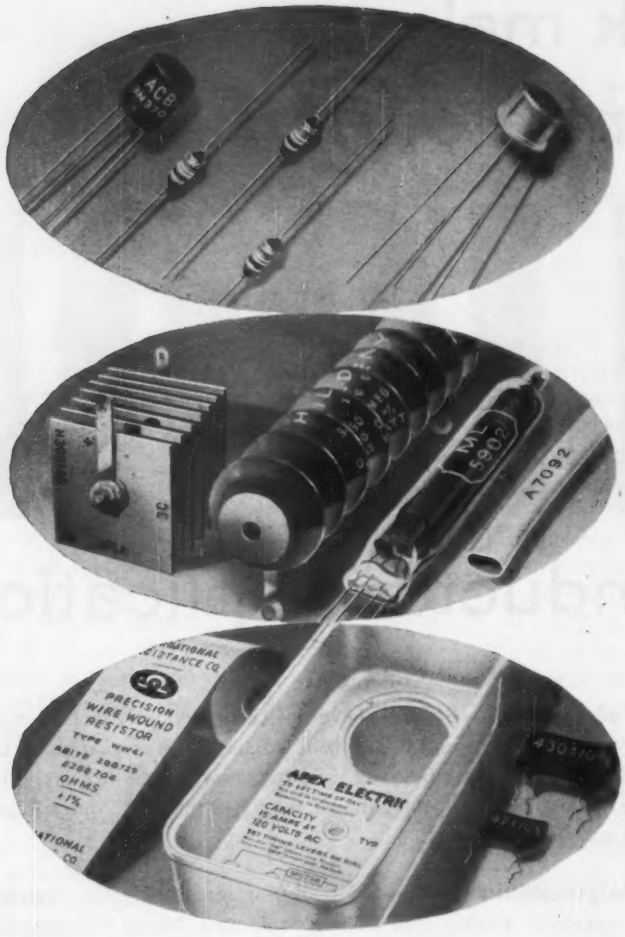
For additional information on specific applications and processes, write Merck & Co., Inc., Electronic Chemicals Division, Dept. ES-7, Rahway, N.J.

ULTRA-PURE
SILICON —a product of MERCK

BASE BORON CONTENT BELOW ONE ATOM OF BORON PER SIX BILLION SILICON ATOMS



MARK *it rapidly, clearly, durably*

... with the **MARKEM METHOD**

24 HIGH PRODUCTION MARKEM MACHINES

MARK PARTS OF ALL SIZES AND SHAPES . . . TUBING, TAPE AND LABELS . . . BOXES AND PACKAGES

Imprint, color band, or screen process print your products and packages at *production* rates — in the quantities you need *as* you need them. Save the time, cost, delays and waste involved in hand stamping — or stocking large label inventories. Markem specialty inks answer adhesion, clarity, drying speed, special "environmental" requirements. Locate machines anywhere in your plant, or integrate with other operations; use one machine for several jobs. Change imprint in seconds with quick change printing elements.

Leading electrical/electronic manufacturers throughout the country are using hundreds of Markem machines for faster, *better* marking. You can, too. Ask Markem for recommendations; enclose samples (if possible) to be marked. New catalog describes all machines for electrical/electronic industries, shows typical items marked. Write Markem Machine Co., Keene 5, N. H.

MARKEM

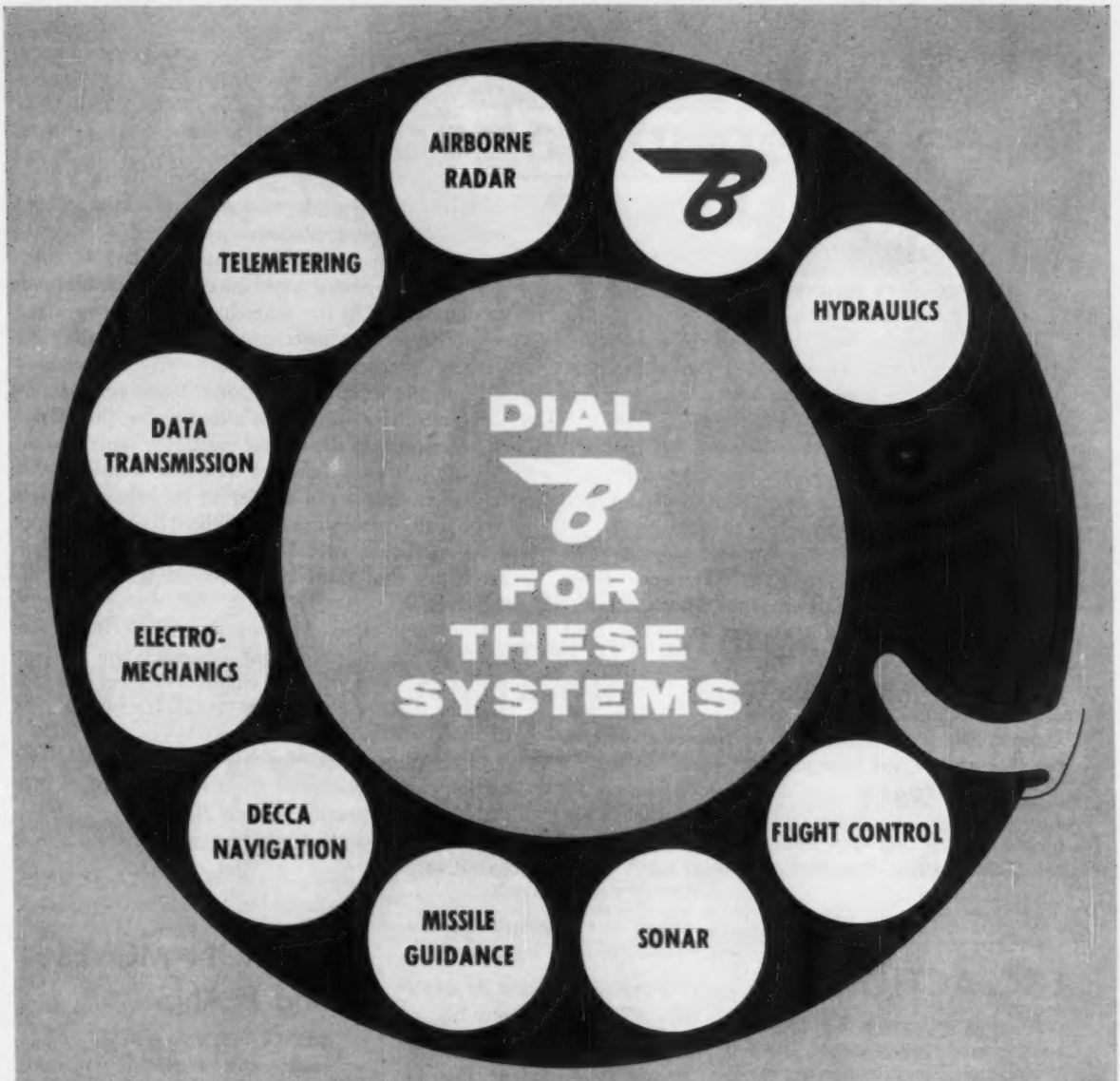
644 tv sets in the first half of 1958 compared to 6,502 in the same period last year. This was still behind the goal of 24,000 sets for the six months; planned production increase during the second half of 1958 is supposed to boost output to 69,000 sets for the year.

In Tokyo a card-programmed steel mill for the Nippon Kokan K.K.'s Mizue Works will be the first overseas application of Westinghouse Electric Corp.'s new Prodac control system. When completed in 1959, the installation will be part of a new semicontinuous hot carbon steel strip mill. As in the case of similar U.S. systems, the mill will carry out a complete rolling schedule according to data stored on a single punched card.

In Pakistan a Marconi vhf system has been installed in the port of Karachi to improve operational efficiency and control movements of tugs and pilot launches in the harbor and its approaches. System uses 10-w f-m transmitter/receivers arranged for duplex operation. Fixed stations are located in the offices of the harbor master, dock master and the port's mechanical engineer; five mobiles are aboard three tugs and two pilot launches.

In Peru Cominco S.A. has completed and installed a 10-kw radio-teletypewriter transmitter for Agency France Presse, six 1-kw broadcast transmitters and 15 300-w broadcast repeater transmitters for provincial stations. Cominco says these are the first large transmitters made in Peru. Firm says it purchases most of its small components from U.S. firms but manufactures its own cabinets, transformers, large variable air capacitors and coils.

British firm is exporting a new electronic instrument for checking car engine performance. Crypton Equipment Ltd., Bridgewater, Somerset, England, says its 15 × 22 × 8-inch instrument weighs 38 pounds, is available in a variety of mountings and with a number of supplementary instruments, and carries out seven sequence tests covering nearly 50 points in 10 minutes.



Bendix-Pacific Systems capabilities are being demonstrated in four distinct ways: Through imagination in research... through creativeness in engineering... through practicability in testing... and through performance in service. In addition, the diversity of product lines in which Bendix-Pacific specializes contributes unusually broad know-how, which assures design of the best system without prejudice.

There are excellent opportunities with a secure future for engineers at Bendix-Pacific. Please write to R. A. Lomm, Director of Engineering.

Bendix-Pacific
DIVISION OF BENDIX AVIATION CORPORATION
NORTH HOLLYWOOD, CALIFORNIA

ADVANCED THINKING FOR SYSTEMS AND PRODUCTS IN AIRBORNE RADAR... HYDRAULICS... MISSILE GUIDANCE... ELECTRO-MECHANICS... DECCA NAVIGATION... SONAR... TELEMETRY.

Rise Seen in Taped Tv

Use of tape in making tv commercials is pointing the way to new sales of recorders and tv camera chains

TREND TAKING SHAPE this Fall is the use of magnetic tape recording for tv commercials. This is expected to open up a new market area for tv tape recorders and tv camera chains.

Check this week by ELECTRONICS shows that several New York producers of tv commercials have already purchased tape recorders and camera chains. A black and white recorder costs $45,000.

Main selling point for the tape technique is playback speed. Filmed commercials take two to three days to process for preview. Tape allows production review immediately after the "shooting", and on-the-spot correction of errors.

Camera chain equipment is usually vidicon, includes three or four pickup cameras. To date, few commercials have been done in color. Producers say this may be the case for some time.

A saving offered by tape is that it can be erased and used over once it has served its purpose. One hour's running time uses $300 worth of tape.

Need for maintenance personnel may delay slightly the wider adoption of magnetic tape commercials. As one producer puts it, "For film, we have experience going back to the days of silent movies, on tape our experience goes back a couple of months." On the other hand, another firm says it's relatively easy to train a newcomer to the business in tape production.

From the technical viewpoint, taped commercials will have the advantage of allowing the production to be made with the correct electronic signal characteristics. In many cases, a film that seems suitable to the producers can appear to be below standard when used with studio equipment that is not set for its particular light levels and other variable characteristics that must be translated into electronic signals.

Comment along Madison Avenue is that some agencies are also becoming customers for tv tape equipment and camera chains. Current general practice is for the agency to use tv station facilities or work with a commercial producer.

Other users predicted for the tape recording-camera chain equipment are medical schools. Visitors to the American Medical Association Convention last June studied taped recordings of an actual operation.

FCC ACTIONS

• **Grants** requests of GE Laboratories and Institute of Hi-Fi Manufacturers for extension of time to October 2 for filing comment on increased use of f-m subsidiary channels.

• **Releases** technical report on analysis of long term fading ranges for tv and f-m service fields. Copies are available on request to Commission's technical research division.

• **Grants** c-p to WBEN, Buffalo, N. Y., for installation of new type antenna, increased erp to 110 kw, and increased antenna height to 1,350 feet.

• **Notes** filing by Pennsylvania Broadcasting Co., Philadelphia, for voluntary assignment of license and construction permit to WIP Broadcasting, Inc.

• **Accepts** application from Clover Park School District 400, Tacoma, Wash., for change in location to Lakewood City.

• **Accepts** application from Plains Broadcasting Co., Amarillo, Tex., for new f-m station on 93.1 mc, channel 226, erp 14.6 kw with 441-ft antenna height above average terrain.

• **Issues** final tv broadcast data on financial revenues for 1957.

• **Grants** permission to Biscayne Tv Corp., Miami, Fla., to raise erp of WKCR to 100 kw. Permission also granted to decrease antenna height to 250 ft, install new type antenna.

STATION MOVES and PLANS

KOMA, Oklahoma City, Okla., plans sale of station to Stortz Broadcasting Co. for $600,000.

KBG, San Diego, Calif., files application for permission to operate transmitter by remote control.

WAYX, Waycross, Ga., requests c-p for increase in daytime power from 250 w to 1 kw, and installation of new transmitter.

KDEF, Albuquerque, N. M., seeks c-p to change hours of operation from daytime to unlimited, using 500 w daytime, 1 kw night with directional antenna.

KDPS-TV, Des Moines, Ia., (Community School District) is granted modification of c-p to change erp,

raise antenna height 320 ft, change type of transmitter.

WGTE, Toledo, O., is permitted extension of completion date to December 27, 1958.

KGLD, Garden City, Kans., files for application to change erp from visual 45.7 kw–aural 22.9 kw, to visual 49.3 kw–aural 24.7 kw.

KCNO, Alturas, Calif., plans voluntary assignment of license from Interstate Broadcasting Co. of Oregon, Inc., to Stultor Corp.

KSFE, Needles, Calif., files for license to cover c-p authorizing installation of new transmitter.

WMAZ-FM, Macon, Ga., applies for permission to operate transmitter by remote control.

WCIA, Champaign, Ill., files application for renewal of license.

WBOW, Terre Haute, Ind., plans installation of old main transmitter as auxiliary, and remote operation from studio location.

WMCD, Welch, W. Va., seeks voluntary assignment of license from Williamson Broadcasting Corp. to Welch Broadcasters, Inc.

KIHN, Hugo, Okla., plans sale of station to D. W. Brawner who also owns station KFTV, Paris, Tex.

WERE, Cleveland, O., receives permission to change from auxiliary operation of transmitter to alternate main operation.

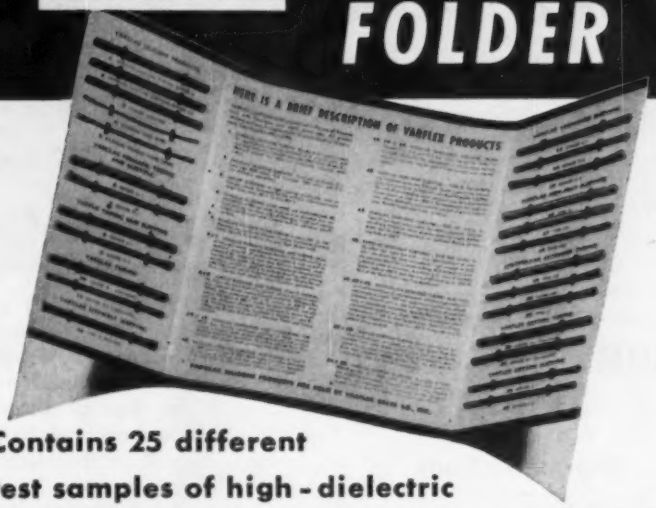
KTKN, Ketchikan, Alaska, applies for license to cover c-p authorizing installation of a new transmitter.

KACY, Port Hueneme, Calif., seeks license to cover c-p authorizing new standard broadcast station at 930 kc.

WFBR, Baltimore, Md., requests authority to determine operating power of auxiliary transmitter by direct measurement of antenna power.

Send for this

FREE SAMPLE FOLDER



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Includes samples and descriptions of . . .

VARGLAS SILICONE—Class H tubing, sleeving, lead wire, tying cord. Withstands temperature from —85°F to 500°F.

PERMAFIL-IMPREGNATED VARGLAS TUBING—Fiberglas impregnated with General Electric Permafil.

VARGLAS SLEEVING AND TUBING—synthetic-treated, varnished, lacquered, saturated and others.

VARGLAS NON-FRAY SLEEVING—three types available. Withstands temtemperatures up to 1200°F.

VARFLO TUBING AND SLEEVING—full range of colors, sizes and grades. Vinyl coated Fiberglas.

VARFLEX COTTON TUBING AND SLEEVING—varnish or lacquer impregnated—all NEMA grades.

SYNTHOLVAR EXTRUDED TUBING—listed by UL for use at 105°C. Various formulations to meet unusual requirements.

Varflex CORPORATION
Makers of Electrical Insulating Tubing and Sleeving

MAIL COUPON TODAY FOR SAMPLE FOLDER

VARFLEX CORPORATION
506 W. Court St., Rome, N. Y.

Please send me free folder containing samples of your electrical tubing and sleeving.

I am particularly interested in insulation for .....

Name .....

Company .....

Street .....

City ..... Zone ..... State .....

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(Classified Advertising)

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An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

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$2.40 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Positions Wanted take one-half of above rate.
Box Numbers in care of our New York, Chicago & San Francisco offices count as one additional line.
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WEST COAST REPRESENTATION

Serving all missile, aircraft and electronic manufacturers on the West Coast for over 15 years. Territory includes California, Washington, Oregon, Arizona, and Nevada.

C. E. FISHER CO. TE 0-6751
2660 So. La Cienega Blvd. L. A. 34, Calif.

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New finest high-quality multi-tap potentiometer meeting rigid military specifications selling for substantially less than comparable commercial products. 36 multi-tap model sells for $99.00.

All national territories open. Direct replies to
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1531 SPRUCE STREET, PHILA. 2, PA.
Territory: Pennsylvania • New Jersey • Delaware • Maryland • Virginia • West Virginia • District of Columbia
Other Offices: Pittsburgh • Baltimore • Washington, D.C.

PLANTS and PEOPLE

Schaevitz Gets More Space

COMPLETION of its move from Camden to a new 50,000 sq ft plant (picture) in Pennsauken, N. J., is announced by Schaevitz Engineering. New plant will house on one floor all offices, research development and test facilities, as well as manufacturing operations.

This is the third time in the past three years that Schaevitz has outgrown its quarters and had to expand its plant. According to Herman Schaevitz, president, plans are already under way for additions to the new structure.

Company's rapid growth has resulted from its new developments in electronic devices for measuring, recording and controlling pressure and temperature. Recent contracts awarded to Schaevitz for development and production exceed $1 million.

ITT Labs: Ten New Directors

APPOINTMENTS of ten new laboratory directors at ITT Laboratories were recently announced. ITT Laboratories is the U.S. research division of International Telephone and Telegraph Corp.

The new directors have been assigned to the firm's Nutley, N. J., headquarters and branch laboratories in Ft. Wayne, Ind., Chicago, San Fernando, Calif., and Palo Alto, Calif. The Laboratories organization combines the research facilities of Federal Telecommunication Laboratories, with those of ITT's Farnsworth Electronics Co. and Kellogg Switchboard and Supply Co.

Those appointed and their fields of responsibility are:

Ben Alexander, Avionic Systems, Nutley; Anthony M. Casabona, Avionic Transmission, Nutley; Wilbur S. Chaskin, Communication Systems, Palo Alto; Albert E. Cookson, Missile Guidance, Nutley; Leonard E. Gough, Electronic Countermeasures, Ft. Wayne; Leon Himmel, Defense Countermeasures, Nutley; J. Alvin Henderson, Components and Instrumentation, Ft. Wayne; Christian C. Larson, Infrared Systems, San Fernando; Keith L. Liston, Communication Systems, Chicago; and William Sichak, Radio Communication, Nutley.

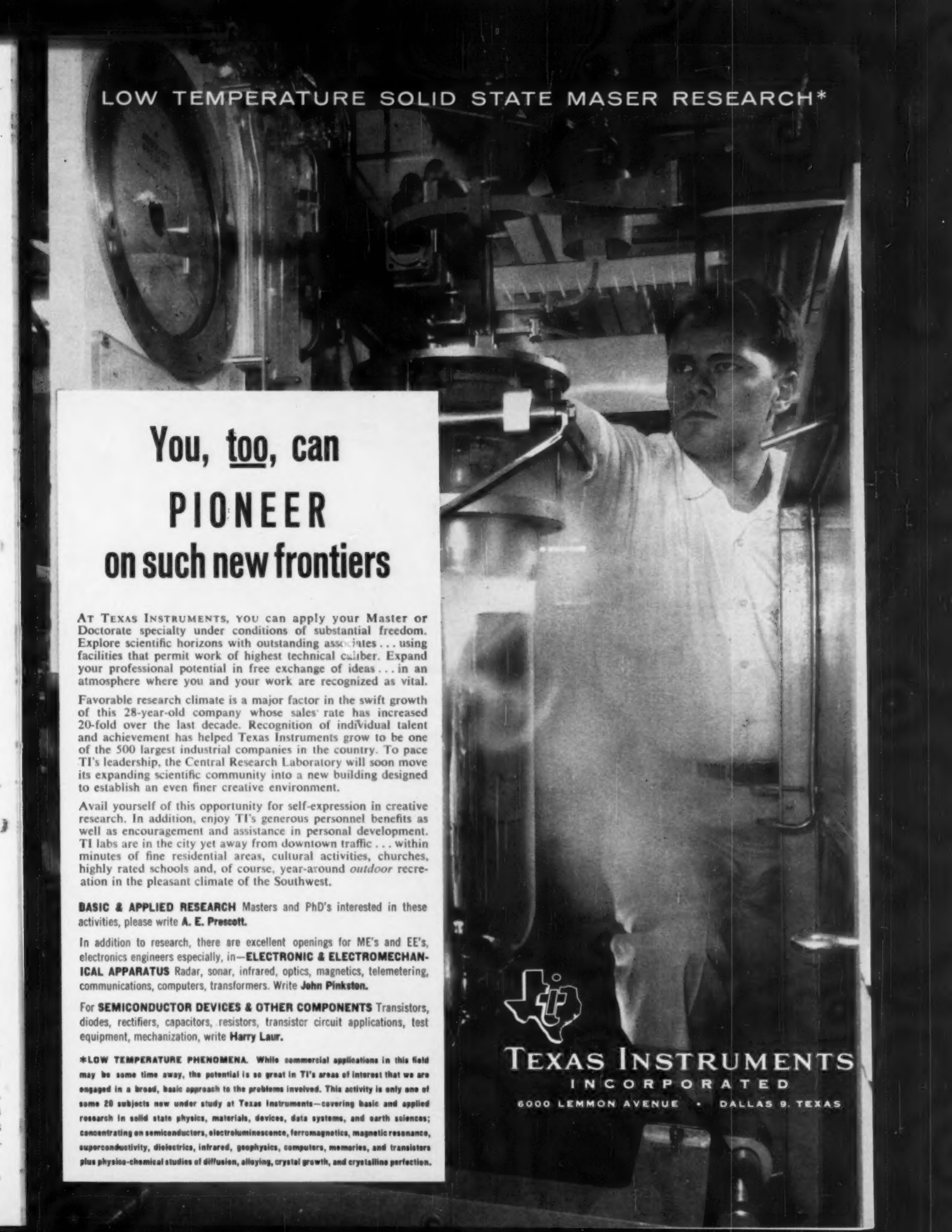
ITT Laboratories employs more than 3,100 scientists, technicians and supporting personnel and has more than 570,000 sq ft of floor space, including special facilities in Belleville, N. J.

Epsco Sets Up New Division

IN A SIGNIFICANT expansion move, Epsco, Inc., Boston, Mass., announces formation of a West Coast Division at Anaheim, Calif.

Location of Epsco-West, as it is to be called, will be central to a large number of current and prospective users of Epsco systems and equipment.

The new division will market, design and produce high-speed data processing and data control systems for military and commercial appli-



You, too, can PIONEER on such new frontiers

AT TEXAS INSTRUMENTS, YOU can apply your Master or Doctorate specialty under conditions of substantial freedom. Explore scientific horizons with outstanding associates . . . using facilities that permit work of highest technical caliber. Expand your professional potential in free exchange of ideas . . . in an atmosphere where you and your work are recognized as vital.

Favorable research climate is a major factor in the swift growth of this 28-year-old company whose sales rate has increased 20-fold over the last decade. Recognition of individual talent and achievement has helped Texas Instruments grow to be one of the 500 largest industrial companies in the country. To pace TI's leadership, the Central Research Laboratory will soon move its expanding scientific community into a new building designed to establish an even finer creative environment.

Avail yourself of this opportunity for self-expression in creative research. In addition, enjoy TI's generous personnel benefits as well as encouragement and assistance in personal development. TI labs are in the city yet away from downtown traffic . . . within minutes of fine residential areas, cultural activities, churches, highly rated schools and, of course, year-around *outdoor* recreation in the pleasant climate of the Southwest.

BASIC & APPLIED RESEARCH Masters and PhD's interested in these activities, please write **A. E. Prescott.**

In addition to research, there are excellent openings for ME's and EE's, electronics engineers especially, in—**ELECTRONIC & ELECTROMECHANICAL APPARATUS** Radar, sonar, infrared, optics, magnetics, telemetering, communications, computers, transformers. Write **John Pinkston.**

For **SEMICONDUCTOR DEVICES & OTHER COMPONENTS** Transistors, diodes, rectifiers, capacitors, resistors, transistor circuit applications, test equipment, mechanization, write **Harry Laur.**

***LOW TEMPERATURE PHENOMENA. While commercial applications in this field may be some time away, the potential is so great in TI's areas of interest that we are engaged in a broad, basic approach to the problems involved. This activity is only one of some 20 subjects now under study at Texas Instruments—covering basic and applied research in solid state physics, materials, devices, data systems, and earth sciences; concentrating on semiconductors, electroluminescence, ferromagnetics, magnetic resonance, superconductivity, dielectrics, infrared, geophysics, computers, memories, and transistors plus physico-chemical studies of diffusion, alloying, crystal growth, and crystalline perfection.**

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE • DALLAS 9, TEXAS

JK
PRODUCTS

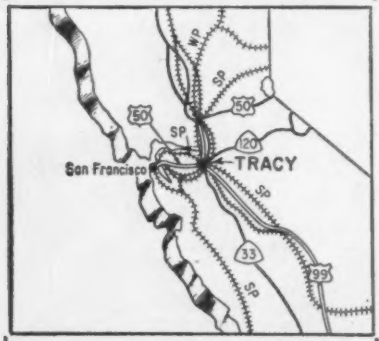
CRYSTALS
FILTERS

Compact, rugged, hermetically-sealed and stable, JK Crystal Filters (band pass filters) have a Frequency Range: 20 kc to 17.5 mc., and are available for special filtering purposes to 150 mc. Band Width at 6 db: 0.01% to 4% of nominal on most frequencies, up to 12% for certain frequencies. Write for complete data.

The
JAMES KNIGHTS COMPANY
Sandwich 1,
Illinois

CIRCLE 34 READERS SERVICE CARD

TRACY, CALIFORNIA



CITY OFFERS CHOICE INDUSTRIAL SITE AT $2500 PER ACRE

- Three-acre site now available in tract being sold by City of Tracy. Price includes water and sewer lines to property.
- All utilities adjacent, rail, excellent street and highway access. SP spur. Near US 50. Modern new plant has built on first 3 acres sold.

Investigate Industrial Opportunities in Tracy

- Key Transportation Center For Serving the West.
- Planned Industrial Sites, 3 to 300 acres.
- Professional Engineering, Architectural, Construction Services Available.
- Excellent Business Climate and Master Plan.
- Hub for Recreational, Educational Activities.

Write Today:
Factual Industrial Sites File
Tracy District Chamber of Commerce
Tracy, California

CIRCLE 33 READERS SERVICE CARD

cations. It will also be responsible for the sale of Epsco's line of Datrac voltage-digital converters and other system building blocks.

Wallace E. Rianda has been designated vice-president and general manager of Epsco-West, and William F. Gunning is to be technical director. Ralph McCurdy will be in charge of production.

Plant Briefs

The Sangamo Electric Co., Springfield, Ill., has purchased the D.G.C. Hare Co. of New Canaan, Conn., as a wholly owned subsidiary. Products of the Hare Co. complement the electronic lines now being manufactured by Sangamo.

News of Reps

Astron Corp., East Newark, N. J., appoints the **Texport Co.** to handle its capacitor and filter line in Louisiana and Texas (except El Paso).

NYT Electronics, Inc., Burbank, Calif., manufacturers of magnetic devices, has appointed additional reps to handle their new line of r-f chokes:

The William M. Jones Co. will represent the company in southern New Jersey, eastern Pennsylvania, Maryland, Delaware, District of Columbia, Virginia, North and South Carolina, Georgia, Florida, Alabama and Tennessee.

H. P. Woodit Associates will cover northern New Jersey, New York City, southeastern New York state, and Connecticut.

Wallace E. Connolly will handle sales in northern California, and **Packard Associates** will represent NYT in Texas, Oklahoma, Arkansas and Louisiana.

Messenger Sales Co. is named New England sales rep by Commercial Products Corp., Chicago, Ill., manufacturers of wire and cable clamps.

Aladdin Electronics, a division of Aladdin Industries, Inc., announces the appointment of the **P. J. Engineering Sales Co.** to cover the New England states.

INDEX TO ADVERTISERS

American Standard, American Blower Div. 32

Barnstead Still & Sterilizer Co., Inc. 10
Bausch & Lomb Optical Co. 29
Beattie Coleman Inc. 36
Bendix-Pacific Div. of Bendix Aviation Corp. 43
Black & Webster, Inc. 39

Clevite Transistor Products Div. of Clevite Corp. 7

Dade County Development Department ... 38
Dow Chemical Company 11

General Radio Co. ..... 3rd Cover
General Transistor Corporation 25
Grace Electronic Chemicals, Inc. 21

Hewlett-Packard Company 4
Hi-G Inc. 37

Jacksonville Chamber of Commerce 34
Jones & Lamson Machine Co. 5

Kearfott Company, Inc. 13
Kennedy & Co., D. S. 14
Knights Company, James 48

Ling Electronics, Inc. 35

MacDonald Inc., Samuel K. 46
Malco Tool and Mfg. Co. 34
Markem Machine Co. 42
Merck & Co., Inc. 41

North Electric Company 3

Ohio Semiconductors, Inc. 38

Pacific Automation Products, Inc. 9

Radio Corporation of America ..... 4th Cover
Raytheon Manufacturing Co. ..... 2nd Cover

San Jose Chamber of Commerce 36
Specialty Automatic Machine Corp. 37
Stokes Corporation, F. J. 31

Technitrol Engineering Co. 27
Tracy District Chamber of Commerce ... 48
Tung-Sol, Electric Inc. 12, 33

Varflex Corporation 45
Virginia Electric & Power Company 22

MANUFACTURERS REPRESENTATIVES 46

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES ... 46, 47
BUSINESS OPPORTUNITIES 46

ADVERTISERS INDEX
Fisher Company, C. E. 46
Hopper & Associates, John T. 46
Texas Instruments Inc. 47
United International Dynamics Corp. 46

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(1) Circle number on postpaid card below that corresponds to number at the bottom of Advertisement, or New Product item.

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Certain multi-product advertisements contain Reader Service numbers for each product.

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17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124
131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146
153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168
175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190
197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212
219	220	221	222	223	224	225	226								

81	82	83	84	85	86
103	104	105	106	107	108
125	126	127	128	129	130
147	148	149	150	151	152
169	170	171	172	173	174
191	192	193	194	195	196
213	214	215	216	217	218

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17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124
131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146
153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168
175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190
197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212
219	220	221	222	223	224	225	226								

81	82	83	84	85	86
103	104	105	106	107	108
125	126	127	128	129	130
147	148	149	150	151	152
169	170	171	172	173	174
191	192	193	194	195	196
213	214	215	216	217	218

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MEMO:

NEW PRODUCTS RELEASES

TO: ALL MANUFACTURERS

FROM: electronics

electronics publishes all new product items of interest to makers and users of electronic and allied equipment.

The reverse side of this card provides a service to subscribers by facilitating the flow of additional information between manufacturers and our readers.

Take advantage of Reader Service--and the readership of electronics...keep the industry informed about your New Products and New Literature via their mention in the editorial pages of electronics.

FIRST CLASS
PERMIT NO. 64
(SEC. 34.9 P.L.&R.)
NEW YORK, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

6¢ Postage Will Be Paid By

ELECTRONICS
Reader Service Dept.
330 West 42nd Street
New York 36, N. Y.

FIRST CLASS
PERMIT NO. 64
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NEW YORK, N. Y.

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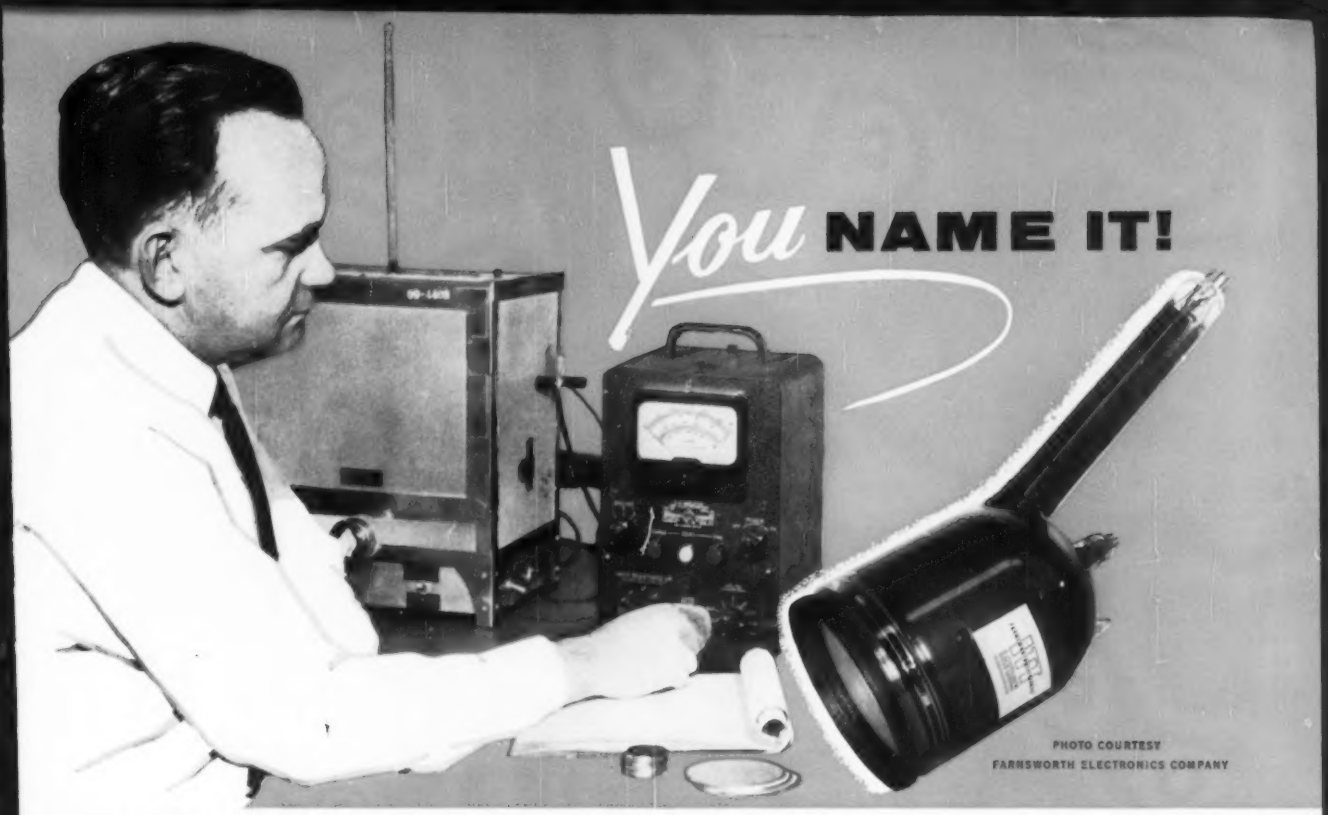

Electrical leakage of silicon-oxide storage surfaces used in Farnsworth's Iatron Tubes is measured by the sensitive and stable G-R Electrometer and D-C Amplifier. The Electrometer's direct calibration in ohms, stable, built-in voltage source which is low enough to prevent breakdown in thin films, and the ease with which it can be switched for either polarization-voltage evaluations or resistance-linearity checks, have all proven valuable time and money saving features in production, as well as development.

Milli-voltmeter, Micro-microammeter, Mega-megohmmeter, or D-C amplifier

. . . we call this instrument the

Type 1230-A D-C Amplifier and Electrometer

Type 1230-A D-C Amplifier and Electrometer . . . $440

It measures *directly* voltages as low as 0.5 mv, currents as low as 5×10^{-15} amp, and resistances as large as 5×10^{14} ohms. No vibrating parts — the G-R Electrometer is a true direct-coupled amplifier. It has high sensitivity and excellent stability — drift is less than 2 mv per hour after one-hour warmup. High input resistance, even under conditions of high humidity, are achieved by use of: an electrometer tube in the first of three direct-coupled stages (input grid lead is enclosed in silicone-treated glass); and switch contacts mounted on individual teflon bushings set in a metal base that connects to a guard point.

Besides its multipurpose abilities, the Electrometer is convenient to use. Its switching arrangement allows you to change functions rapidly . . . from high-impedance voltmeter, to low-impedance ammeter, or to a megohmmeter, *without need of accessory multipliers or shunts*. Other conveniences include built-in resistance standards for current and resistance measurements, and for calibration. Guard terminals are provided so that either 2- or 3-terminal measurements may be made. Output jacks, at the rear, permit use as a sensitive d-c amplifier to drive graphic recorders having input resistances up to 1500Ω (5-ma models can be connected directly).

Typical of this instrument's uses are measurements of ionization currents, grid currents in electron tubes, piezoelectric and contact potentials, and back resistance of silicon-junction diodes. A low-cost instrument of high performance has not been previously available for such work.

Voltage Ranges: ±30 mv, 100 mv, 300 mv, 1 v, 3 v, and 10 v; dc, full scale. Accuracy is ±4% of full scale on 30 mv range, ±2% on all other ranges.

Current Ranges: ±300 milli-micromicroamperes d-c (3×10^{-13} amp) full scale to ±1 milliampere full scale in twenty ranges (two per decade). Full-scale accuracy is ±3% to ±10% depending on multiplier position.

Drift: Less than 2 mv per hour after one-hour warmup.

Resistance Ranges: 300 kilohms to 30 megamegohms ($3 \times 10^{13}\Omega$) in 16 ranges. Accuracy is ±3% to ±10% depending on multiplier and on meter deflection. With external 600 v battery in place of the internal 9 v source, resistance range can be extended to read $1.2 \times 10^{17}\Omega$ at smallest meter division.

Write For Complete Information

Input Resistance: Determined by setting of resistance standards (ohms multiplier) switch: 10^4, 10^5, 10^6, 10^7, 10^8, 10^9, 10^{10} and $10^{11}\Omega$; also "zero" and "infinity" positions. At "infinity" position, it is approximately 10^{14} ohms.

Output: Voltage, current, and resistance are indicated on a panel meter. Terminals provided for use with graphic recorders having resistances up to 1500Ω.

Temperature, Humidity, Line Voltage Effects: Negligible.

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Mass., U. S. A.

2-Year Warranty on every Product

NEW YORK AREA: Tel. N. Y. WOrth 4-2722, N. J. WHitney 3-3140 **CHICAGO:** Tel. VIllage 8-9400
PHILADELPHIA: Tel. HAncock 4-7419 **WASHINGTON, D. C.:** Tel. JUniper 5-1088
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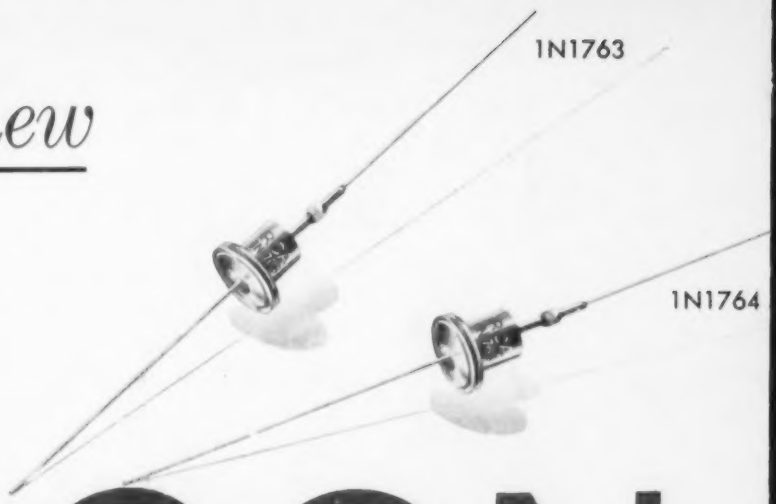
In **CANADA, TORONTO:** Tel. CHerry 6-2171

WE SELL DIRECT. Our District Sales Offices are staffed by engineers especially trained to help you in the selection of instruments and measuring systems best suited to your needs. We welcome your inquiries — will help solve your problems.

Announcing new



RCA SILICON RECTIFIERS

RCA is now in mass production of silicon rectifiers of the diffused-junction type for use in electronic applications. The two types now available are the initial units of a broad line intended for power supplies of entertainment, industrial, and military equipment.

These RCA Silicon Rectifiers Offer You:

- Low Cost—specifically priced for entertainment applications.
- Electrical Uniformity—precision controlled diffusion process forms superior junctions.
- Welded Hermetic Seal—each unit individually pressure-tested to provide complete protection against moisture and contamination.
- Rugged Construction—industrial-type "top-hat" design with axial leads for soldering-in applications; may also be mounted in standard fuse clip.

TYPE	MAXIMUM RATINGS			* CHARACTERISTICS		APPLICATION
	Peak *Inverse Volts	RMS Supply Volts	DC Forward Ma	Max. Reverse Current at Indicated Peak Inverse Volts	Max. Instantaneous Forward Voltage at Indicated Instantaneous Forward Current	
1N1763	400	140	500	100 μa at 400 volts	3 volts at 15 amperes	Black-and-white TV, radios, phonographs and other electronic equipment operating direct from power line
1N1764	500	175	500	100 μa at 500 volts	3 volts at 15 amperes	Color TV, radios, phonographs and other electronic equipment operating from the power line through a step-up transformer

*At ambient temperature of 25°C

New RCA "100 Production Pack" saves time and motion. Package is specially designed for quick, convenient, operator handling. Saves inventory-control time; simplifies the "count".

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Semiconductor and Materials Division

Somerville, New Jersey